Los Angeles County Economic Adjustment Strategy

for Defense Reductions

Public Policy Analysis
by the
Economic Roundtable

Community Development Commission
County of Los Angeles

2525 Corporate Place · Suite 200 · Monterey Park, California 91754
(213) 260-2100 · Telefax: (213) 260-2194

Carlos Jackson
Executive Director

March 13, 1992

The Honorable Joyce L. Hampers
Assistant Secretary, Economic Development Administration
Department of Commerce
14th and Constitution Avenues, NW
Washington, DC 20515

Dear Assistant Secretary Hampers:

It is my pleasure to transmit the enclosed strategy for defense industry downsizing which has been developed for the County of Los Angeles with funding from the Economic Development Administration and the Department of Defense.

The positive assistance your agency provided has been of inestimable value to the Aerospace Task Force in developing this strategy. In particular I want to commend Charles Oaks, the area Economic Development Representative, who has provided essential direction and support.

The Economic Roundtable, the consultant team who developed the strategy for the Aerospace Task Force, has created a valuable resource document. The recommendations contained herein will receive further review by the Aerospace Task Force prior to transmittal to the Los Angeles County Board of Supervisors for their action.

On behalf of the County of Los Angeles and the Aerospace Task Force I thank you for your support of this unique cooperative effort between the public and private sectors.

Sincerely,

Carlos Jackson

CARLOS JACKSON
Executive Director

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LOS ANGELES COUNTY
ECONOMIC ADJUSTMENT STRATEGY
FOR DEFENSE REDUCTIONS

March 17, 1992

Prepared under grant number 07-09-03258 from the United States Department of Commerce Economic Development Administration to the Community Development Commission of Los Angeles County.

Economic Roundtable
315 West Ninth Street, Suite 310
Los Angeles, California 90015
(213) 892-8104

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Aerospace Task Force

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INTRODUCTION

This report recommends an economic adjustment strategy to reduce severe job losses being caused by cutbacks in defense funding for Los Angeles County industries. This work has been carried out under an Economic Development Administration grant awarded to the County of Los Angeles Community Development Commission.

An interdisciplinary team was assembled to gather and analyze information about the labor market, industries, economy and defense linkages of Los Angeles County. The team includes distinguished and exceptionally qualified researchers who have contributed much of their own time to gathering new information and linking it to concrete policy recommendations for improving future economic prospects in Los Angeles County. Questions that have been investigated include:

- What are the impacts of defense cutbacks on Los Angeles County?
- Who in Los Angeles needs help?
- Where is help needed?
- What kind of help is needed?
- What kind of help is it possible to provide given the resources and constraints of county, state and federal budgets?
- What kind of help will most effectively meet the immediate and long term needs of workers and industry in Los Angeles County?

We would like to thank the Economic Development Administration for making this work possible, the Community Development Commission for enabling us to carry it out, the Economic Development Corporation for supporting our efforts, the Aerospace Task Force for the dedicated efforts of its members, and Supervisor Edmund D. Edelman for enlisting the cooperation of aerospace leaders. I would like to express special thanks to my colleague, Elizabeth Reid, who has skillfully and insightfully done much of the work for this report.

Daniel Flaming
Editor

Executive Summary

MISSION

On June 26, 1990, the Los Angeles County Board of Supervisors took unanimous action to seek Economic Development Administration (EDA) funding for a strategy to mitigate problems created by defense downsizing. Earlier the Board of Supervisors had created the Aerospace Task Force to help formulate its economic strategy. This report contains findings, analysis and recommendations produced through the EDA grant to assist the Aerospace Task Force, the Board of Supervisors and other policy makers in taking strategic action.

FINDINGS

Overview

Federal funding for defense is falling sharply, and the local share of this funding is dropping even more rapidly. Defense manufacturing is heavily focused in a handful of large firms that have limited capacity to convert their resources to civilian applications. Furthermore, there is a growing possibility that more of these firms will move significant sections of their blue-collar production activities out of the region.

Aerospace, Los Angeles County's most important manufacturing industry, has been declining since 1987, and this process of decline accelerated during the 1990s. An industrial development strategy could help salvage aerospace's capital investment and the economic productivity of its skilled workforce by improving prospects for retaining current industries. It could also help spark a new, dynamic growth trajectory for the region's economy. Los Angeles is at the cutting edge in developing new technologies in energy sources, electronics, space exploration, advanced materials, instruments, and other emerging areas of commercial activity. It is also creating new markets for emission control and transportation technologies as it establishes novel precedents for improving air quality. Linking aerospace manufacturing capabilities to these budding industries is essential for Los Angeles' continued economic well being.

Significance of Aerospace

With total employment of 225,600 workers as of December 1991, the aerospace industry represents 5% of the County's total employment and 24% of its manufacturing jobs. The Economic Roundtable survey

indicated that in 1991, Los Angeles County high technology firms had annual sales of approximately $30 billion.

Aerospace is even more significant for Los Angeles County's economy than its employment and sales indicate. Aerospace workers earn from 10% to 20% more than their counterparts in the same occupations in other industries. Approximately 86% of the County's aerospace workers live within the County, as compared to 68% for the total County work force.

Defense Dependency

Los Angeles County receives twice as much defense funding as any other county in the United States. In Fiscal Year 1990, 1,283 Los Angeles County firms received 4,184 Department of Defense (DoD) contracts worth $8.9 billion.

Los Angeles County's aerospace industry relies on the DoD for two-thirds of its revenue. The typical aerospace firm in Los Angeles County sells 54% of its products to DoD. Weighing this average by firm size, 65% of sales are to the DoD. For very large firms the median dependency on sales to DoD is 97%.

A few large firms and major contracts dominate the industry. The ten largest firms received 80% of Los Angeles County's defense revenue in 1990, with the ten largest contracts accounting for 40% of that total.

Aerospace Performance

Aerospace employment fell by 47,100 jobs from 1988 to 1991, a loss of 17%. From 1987 to 1990 defense funds coming to Los Angeles County declined by about 20%, adjusted for inflation, and the number of contracts declined by 22%.

The kind of defense work being done in Los Angeles County is changing. DoD expenditures for products manufactured in Los Angeles County have declined from nearly $6 billion in 1987 to about $3.3 billion in 1990. Expenditures for Research Development Test and Evaluation, and for Services have remained stable or grown. Most of Los Angeles County's defense business is now for Research Development Test and Evaluation Services. Without a production base this also will decline.

Much of the DoD revenue loss has resulted from reduced aircraft production. Defense funds are concentrated in the aircraft industry, but this industry's future prospects in Los Angeles County are bleak. Of thirteen aircraft produced or developed in Los Angeles County in the 1980's, only two, the B-2 and the C-17, are still active. Given that

there is only one major new military aircraft program anticipated until well into the twenty-first century, aircraft production in Los Angeles County may end with completion of the C-17 program.

Industry Forecast

The defense budget is established through joint actions of the Legislaive and Executive branches based on their assessment of defense needs and other national priorities. This is a continuous decision making process and therefore future DoD expenditure levels cannot be predicted with certainty. Based on analysis contained in this report, three possible ranges of aerospace lay-offs have been projected, and a multiplier of two has been used to project the total job loss in each range. The low range reflects the possibility of lower than expected reductions in defense procurement. The middle range reflects current forecasts for the federal budget. The high range reflects accelerated defense cutbacks.

AEROSPACE LAY-OFFS
Range of Impacts 1992 to 1995

Range of Losses	Number of Aerospace Jobs Lost	Number of Secondary Jobs Lost	Total Jobs Lost
Low Range	35,000	70,000	105,000
Middle Range	70,000	140,000	210,000
High Range	140,000	280,000	420,000

A major area of vulnerability is the potential loss of the Los Angeles Air Force Space Division. The Air Force Space Division, located in El Segundo, is a crucial facility for many of the County's most advanced space and electronics research and manufacturing programs. If this facility is relocated, over a billion dollars a year in aerospace payroll associated with this facility is likely to be lost. This could well move aerospace cutbacks and dislocations into the high range.

The County's future defense strengths are in: subcontracting and components for new aircraft, spare parts and modifications for existing aircraft, and space and communications. The strength in space and communications has enabled Los Angeles firms to gain a large share

of funding from the Strategic Defense Initiative, an important future program for the County's aerospace industry.

Business Environment

The County's business environment is viewed by high technology industries as having both exceptional strengths and serious liabilities. Supplier availability, engineers, managers and the weather are considered to be strengths. The costs of Worker's Compensation insurance, housing, real estate and compliance with air quality regulations, the technical difficulties of complying with air quality regulations, and anticipated environmental regulations are considered by high technology firms to be deterrents to doing business in Los Angeles County.

Community Impacts

Continued decline in DoD expenditures through 1995 at the rates experienced in 1990 and 1991 is projected to create impacts by 2001 that will include:

- Residual loss of 184,000 job in the County.
- An increase of $362.8 million in Unemployment Insurance and $147.4 million in Public Assistance costs over the coming decade.
- Cumulative losses to Los Angeles County's economy between 1992 and 2001 of $86.4 billion in personal income and $23.8 billion in retail trade.
- The construction of 122,000 fewer houses and $6.3 billion less in commercial buildings.
- Cumulative losses of $2.27 billion in public sector sales and property tax revenue.

Every eight dollars in lost defense revenue will cause a twenty-eight dollar loss in the County's economy as well as a one dollar increase in costs and lost revenue for state and local government.

Long Term Prospects

The aerospace-defense industry grew rapidly in Los Angeles County over the post-War decades. The industry suffered periodic cyclical downturns, but until the late 1980s, these downturns were always reversed by upturns in federal defense spending. The projected decline in defense spending over the 1990s will have a strongly negative impact on employment in Los Angeles County. This impact

will be greatly magnified by multiplier effects extending from the aerospace-defense complex to other industries in the region. At the same time, there has been a long-term increase in the share of the County's employment base that is accounted for by non-defense jobs. This circumstance provides enhanced opportunities for viable local economic development strategies.

Industrial Diversification

Large defense firms are not easily able to convert their technology and manufacturing resources to commercial projects. Large scale industry diversification will require the public sector to become a central player in stimulating and guiding technology commercialization.

The best growth prospects for the County's high technology industries are found in smaller firms. Most smaller firms, which are also the least dependent on DoD, anticipate employment growth in the next five years; most larger firms anticipate employment loss. Smaller firms are developing diverse commercially viable products that cross industry boundaries and seldom are dependent on DoD.

Restrictions on open communication and collaboration that have been ingrained in defense contractors by DoD are slowing the pace of technological innovation in the County's high technology industrial complex. One of the key challenges for Los Angeles County is finding ways to foster a stable, confident industrial environment that encourages collaborative rather than insular relationships in its high technology industrial complex. Other regions of the United States, Europe, and Japan have developed collaborative industrial networks; Los Angeles County is challenged to foster similar cooperative relationships.

Impacted Workers

From 1988 to 1991 the pool of job seekers in Los Angeles County registered with Employment Development Department increased by 31%, and the proportion of this pool made up of aerospace workers increased by 360%. Between 1988 and 1991 the share of unemployed aerospace workers in the 31-44 year old range increased by 86% as lay-offs reached deeper into the seniority ranks.

Aerospace lay-offs are cutting proportionately across all occupational groups: Managers 7%, Professional and Technical 38%, Clerical 14%, Production 38%. Minorities make up 53% of laid-off aerospace workers.

In 1991 nearly 2,000 high tech jobs were lost each month, with an aggregate loss of 54,200 jobs since 1988. Throughout 1990 a weekly

average of 6,813 unemployed aerospace and high tech workers in Los Angeles County received Unemployment Insurance.

Reemployment Opportunities

Workers now losing jobs in aerospace have better education, broader competencies and more intensive training than in previous lay-offs, but the transition to other jobs will be very difficult, often requiring extensive reeducation and acceptance of lower pay.

Thirty-eight percent of laid-off aerospace workers will probably have to change occupations and be retrained in order to find a new job. Seventy-six percent of those workers needing retraining will require from 6 to 18 months of training to obtain jobs at a skill level comparable to their old jobs.

There are not any industries doing large scale hiring that could absorb aerospace workers. To find new jobs it is necessary to analyze skills of individual workers, examine the local labor market potential for those skills, look at possible alternative occupations, identify industries offering the best job potential, and make use of specific types of training to enhance employability of the individual worker.

Job Training

There is a broadly shared public interest in maintaining a highly skilled and productive advanced technology work force in Los Angeles County. If Los Angeles workers cannot match and exceed the skills and productivity of their counterparts in other regions and countries, not only they but the entire regional economy will suffer from lower employment and wage levels, and a lower standard of living.

Many workers receive brief exposure to outplacement services, but only one to two percent are being retrained. This means that Los Angeles County is losing the productive capabilities of 5,000 skilled workers a year. Training should last from 6 to 18 months to enable workers to obtain jobs at skill levels comparable to their old jobs, but virtually no training is being provided that lasts longer than 3 months.

There is very little capacity in the job training system to provide for basic needs such as maintenance of health insurance so that laid-off workers can remain in training. And there are very few instances in which job training resources are used to augment community college and adult education resources so that a comprehensive package of retraining services can be provided for laid-off workers.

In the most recent year the Public Employment Service had contact with approximately 14,000 laid-off aerospace workers but referred only

1% of them to job training programs, and received employer listings of 5,884 jobs in aerospace occupations but filled only 39% of them.

There is little discernable use of labor market information to guide laid-off aerospace workers into viable new occupations or to coordinate workforce skill development with industrial development strategies.

RECOMMENDATIONS

Industrial Development Strategy

The Los Angeles County economy is currently at a critical turning point in its history. The region has an opportunity to build on its acquired endowments and talents, and move toward high levels of industrial innovation. With appropriate leadership local wages, skills, product quality, and productivity could begin to rise, and the region climb once more to master international markets with its main industrial products.

It is recommended that the Board of Supervisors establish a policy objective of implementing an industrial development strategy for Los Angeles County and that it take the following actions toward achieving this objective:

- Select an organization to build on the information base presented in this report and provide the policy brokering and research service required to develop and implement the County's industrial development strategy.
- Request participation of industry, universities and other appropriate government entities in developing an integrated statement of public goals for mass transportation, environmental quality, alternative energy vehicles, and job creation for high technology workers.
- Act on strategic industrial development opportunities identified in this report that require inter-institutional collaboration.
- Develop a unified approach with the County's Congressional Delegation for obtaining adequate federal resources to respond to economic dislocations caused by defense cutbacks.

Commercializing Technology

A Consortium for Clean Energy and Power Sources is being formed by the University of Southern California, the California Institute of Technology and the University of California, Los Angeles. The

purpose of this Consortium is to accelerate development and commercialization of energy and power technologies through team research and development projects carried out in university and industry laboratories.

This Consortium is an opportunity to link the region's aerospace diversification efforts with what may well become the most advanced and innovative program for energy research and technology commercialization in the world.

It is recommended that Consortium be used to represent the universities of the region in working with government and industry to formulate an industrial development policy, and that start-up funding be provided for the Consortium.

Technical and Financial Assistance

Seed funding and technical assistance for start-up and small high technology businesses can yield increased job creation and industrial diversification. The financial and technical assistance programs should have five main objectives:

1. Diversify the County's industrial base by developing new technology-based companies.
2. Focus on regional strengths and needs.
3. Encourage joint research and development between universities and the private sector.
4. Develop entrepreneurial skills and outlook.
5. Develop a technologically skilled workforce.

The technical assistance program should provide help in the following areas: financing, incubators, prototype testing and development, accounting, legal, federal R&D awards, networking, management, services, education and training, and exporting.

Financial assistance should focus on start-up high technology activities include: proof of concept, exploratory development, prototype or technical demonstration, or product/process development and movement to market.

Facility Reuse

A renovated defense facility could be a catalyst for bringing together organizations and agencies to establish a new advanced surface transportation industry in Los Angeles County. This facility could support rail car, bus, and electric car assembly, as well as related research and development in such areas as composite materials and sensor equipment. Air Force Plant 42 in Palmdale could be the site where these activities converge to create a clean transit center. It is

recommended that the Los Angeles County Board of Supervisors seek Economic Development Administration funds for retrofitting a defense manufacturing facility to support a multi-institutional program for producing advanced transportation equipment.

Air Quality Compliance

It is recommended that aerospace firms be provided with the name and telephone number of a contact person in the Air Quality Management District who will be their point of contact for linking them with the District's New Directions program.

It is also recommended that the Board of Supervisors support the District's interest in establishing an advanced technology industry forum to discuss regulatory issues affecting the high technology industrial complex and also the technologies needed by the District to reduce emissions. It is also recommended that the County support a policy objective of linking the District's Technology Advancement grants with high technology industrial development goals for the region. And it is recommended that a portion of the District's small business loan funds be earmarked to help high technology firms reduce emissions and also become more competitive.

Workers' Compensation

It is recommended that the Board of Supervisors support Workers' Compensation reform measures to improve the system's efficiency in achieving its original objective of providing prompt, reasonable income and medical benefits to victims of work related injuries, regardless of fault.

Information Clearinghouse and Export Assistance

It is recommended that an information clearinghouse be established to collect and disseminate information about:

- Offset transactions which offer potential business opportunities for other firms.
- Foreign trade opportunities.
- Intellectual property which is available for sale or licensing.
- Specifications for technological problems for which firms are seeking a vendor to solve.

It is also recommended that the existing export capabilities of large aerospace firms be used as the springboard for an industrial export program. The goals of these efforts should be to:

- Strengthen collaborative efforts within Los Angeles County's high technology industrial complex to successfully develop, commercialize and export technological innovations.

- Foster the building of in-country relationships.

- Maintain a self-sufficient presence for Los Angeles area firms in major foreign markets.

It is recommended that Economic Development Administration funds be obtained to support start-up and initial operating costs.

Job Training

It is recommended that the Board of Supervisors request the Governor to implement reforms in the job training current system or utilize a more effective alternative mechanism to serve laid-off aerospace workers. Recommended reforms include:

- Expediting the State's pass-through of federal job training funds to the local level.
- Enabling job training funds to be used flexibly to augment the training services provided by community colleges and adult education programs.
- Mandating coordination of Public Employment Service, JTPA, community college, and adult education programs to meet the needs of aerospace workers.

The current level of resources for retraining aerospace workers is not adequate. Once needed reforms have been made in the service delivery system there should be a five-fold increase in the level of federal job training funds to make it possible to provide substantive skills training for at least 3,000 laid-off aerospace workers a year.

CONCLUSION

Local and national need for continuing technological development to solve pressing environmental and transportation problems could provide new market opportunities for Los Angeles County's high technology industrial complex. With a carefully integrated approach of public policy leadership, effective information systems and brokering of public and private interests the County can retain a leading share of current aerospace markets while at the same time gaining first mover advantage in new markets.

Chapter 1

DEFENSE DEPENDENCY AND GROWTH EXPECTATIONS IN THE HIGH TECHNOLOGY INDUSTRIAL COMPLEX

1991 Los Angeles County

By Elizabeth Reid

SUMMARY OF SURVEY FINDINGS

Defense Dependency

- **The typical high technology firm sells 54% of its products to the Department of Defense (DoD). Weighing this average by firm size, 65% of sales are to the DoD.**

- **For very large firms the median dependency was 97%. This dependency translates into 109,595 jobs. Smaller firms are significantly less dependent upon the DoD.**

Growth Prospects

- **Most smaller firms anticipate employment growth in the next five years; most larger firms anticipate employment loss.**

- **Overall the less DoD dependent firms are anticipating growth.**

Linkages to the Los Angeles Economy

- **The high technology firms responding to the survey bring over $16.6 billion into the Los Angeles County economy annually.**

- **Smaller high technology firms are more dependent upon local customers.**

- **The most defense dependent firms make the largest local purchases.**

Business Environment

- **Supplier availability, engineers, managers and the weather are considered by high technology firms to be strengths of the Los Angeles County business environment.**

- **The costs of Worker's Compensation insurance, housing, real estate and compliance with air quality regulations, the technical difficulties of complying with air quality regulations, and anticipated environmental regulations are considered to be deterrents to doing business in Los Angeles County by high technology firms.**

Firm Relocation

- **Most of the firms surveyed (76%) do not anticipate relocating any of their jobs in the next 5 years, however they are predominantly smaller firms.**

- **The 24% of the firms anticipating relocating some or all of their jobs in the next five years represent 61% of the total employment in the survey.**

OVERVIEW OF PUBLIC POLICY IMPLICATIONS

The ties to defense in Los Angeles County run deep and wide. A large and diverse cross section of industries employing hundreds of thousands of people in the County significantly depends on defense contracts awarded to Los Angeles County firms. A survey of over 400 firms was conducted to provide a current, detailed fact base about the County's defense-related industries to support development of the Economic Adjustment Strategy to deal with the restructuring of defense. The findings are striking and significant in their implications for the County's future economic prospects.

Survey results show that Los Angeles County's role as a world leader in high technology industry is at risk. The high technology grouping of industries[1], which make up the bulk of respondents to the survey, directly represent 5% of the County's total employment or 227,800 jobs[2]. Layoffs, retrenchment, and business relocation by this group of industries, which began in earnest in 1987, are a serious and growing problem. As the high technology industry sectors in Los Angeles County undergo a major restructuring that will shape the County's future, a brief window of opportunity is opening that allows local government and industry to influence whether the region will retain its role as a world leader in high technology.

Survey responses indicate that high technology industry in Los Angeles County is split between two significant groups: 1) A very large, highly defense dependent cluster of firms that is declining in employment and beginning to leave the area, and 2) A small, diversified cluster of firms that anticipates employment growth and intends to remain in the area. If the first group's presence in the County continues to decline without the second group growing large enough to fill the void and ease the transition from defense-dependent high technology to commercially driven high technology, the County faces a diminishing role in technology-based manufacturing.

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[1]The term "high technology" as it is used here refers to the Employment Development Department's definition of high technology and includes the following industries: SIC 357 Office/Computing Machines, SIC 366-7 Communications Equipment, SIC 372 Aircraft, SIC 376 Missiles and Space Vehicles, SIC 381 Search and Navigation, SIC 382 Measuring and Controlling Instruments. For the rest of this chapter, unless noted as EDD's high technology industries, that definition is expanded to include other industries essential to the high technology complex such as Engineering/R&D, Business Services, Metal Products.

[2]"Los Angeles-Long Beach Area Labor Market Bulletin" published by the State of California Employment Development Department, for October 1991.

The engine of growth which propelled the County into the vanguard of high technology could become its undoing. Large, successful high technology firms in Los Angeles County have been inextricably linked with the Department of Defense for over forty years. The big firms in high technology in the County are practically one customer firms, depending upon the Department of Defense for about 82% of their total sales[3]. Now, as the Defense budget rapidly shrinks, these firms have gone into decline. Almost all the defense dependent firms are going through layoffs, many in large numbers. Many of these firms are exhibiting typical symptoms of industrial attenuation. These firms have stopped trying to compete so much on the basis of innovation and begin trying to compete on the basis of cost, seeking the lowest seller of labor and capital supplies. An exodus from the County by these firms reflects industry trying to reduce its costs, rather than optimize its technology or skilled labor force.

Repercussions for the County will be immense if this decline continues. Firms with 500 or more employees account for only 4% of the County's high technology establishments, but 77% of its total employment[4]. According to the survey, the annual sales by these large firms account for 84% of total annual sales by the high technology industrial complex. Some of the world's brightest engineers and scientists are employed by these firms. At the present time, the revenue, employment, and technology of these few firms are irreplaceable.

It is important to stem this outflow and revitalize these industries before the decline reaches critical proportions. Survey findings indicate opportunities for two strategies to be utilized by local government and industry leaders. One strategy is to encourage firms to stay in Los Angeles County by making the region more hospitable to high technology industry. Previously, the County's problem has been to control growth; leading edge firms flocked to the area with no real effort on the part of local government or industry. Now, as parts of this industry begin to leave, the business environment of the County must be closely monitored to remove or ameliorate barriers and disincentives to business retention. The second strategy is to assist these high technology firms in diversifying out of defense work and into commercial markets. Until these firms move into commercial markets they will simply be fighting over smaller and smaller pieces of a shrinking defense budget, affording them little opportunity for growth and keeping their futures highly uncertain. However, if they focus on commercial markets these industries have the technology and skilled labor force to enable some of them to become world leaders in non-defense high technology fields.

Non-defense dependent firms in the high technology complex are numerous, dynamic, small, innovative, and anticipating employment growth. Most of these firms do not plan to relocate. It is with these firms that the future of the County's high technology base lies.

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[3]It should be noted that 82% represents the average dependency of very large aerospace firms on sales to the Department of Defense; the median level of dependency for this same group of firms is 97%. See Table 4 for complete survey findings on defense dependency.

[4]Employment Development Department.

Nurtured and encouraged, these firms could be the leaders in the next wave of the County's high technology industrial complex. Although they currently account for about 2% of the County's high technology employment, by sheer firm number they outweigh the other high technology groups: 54% of the surveyed firms are small with 100 employees or less. In the relatively near future, these firms could become leaders in emerging industries such as electric vehicles, fuel cells, alternative fuels, fiber optics, composite materials, and high definition television.

It took today's leading high technology firms almost 40 years to achieve their current size in Los Angeles County. Smaller firms cannot be expected to fill a void left by the large high technology firms for quite some time. In fact, many of the small firms are still significantly dependent on the larger defense-related firms as customers. But a strategy of encouraging innovation, technology transfer, and entrepreneurship will go a long way toward enabling these small firms to increase productivity, grow and contribute to the County's role as a leader in high technology.

ABOUT THE SURVEY

The first requirement for a strategy to deal with defense downsizing is development of an information base about the defense industry in Los Angeles County. To meet this need a survey of the defense related industrial base in Los Angeles County was designed to[5]:

- Obtain a profile of firms doing business with the DoD;
- Show which of these firms anticipate employment growth or decline, and which plan to relocate outside of Los Angels County;
- Assess firms' levels of dependence on the DoD;
- Gauge firms' linkages to the Los Angeles County economy;

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[5]**METHODOLOGY**

The survey forms were developed by the Economic Roundtable, with assistance from the UCLA Lewis Center for Regional Studies and Beltramo and Associates. Administration, tabulation, and analysis of the survey were performed by the Economic Roundtable. Three mailing lists were used for the survey. The principle list was obtained from the Office of Economic Adjustment, Department of Defense and shows Los Angeles County DoD prime contractors from 1987-1990 were . Two additional lists of DoD subcontractors were provided by two local DoD prime contractors.

The Los Angeles County Economic Adjustment Strategy survey of County defense-related firms was conducted by the Economic Roundtable. A long survey form was sent to 400 establishments in Los Angeles County. 104 of these surveys were returned completed. Those firms who would not or could not respond to the long form were given the opportunity to respond to the short form which contained questions about work force size, growth expectations, and changes in location. Information from these questions was used to validate industry responses received through the long survey form. One hundred twenty-one short survey forms were completed and returned, yielding a total response rate of 50%. The survey period was from August to December 1991. Standard Industrial Classification (SIC) codes were assigned according to the firms' listings in various business directories or as appropriate to their products or services offered.

- Learn firms' perceptions of the Los Angeles County business environment; and
- Determine which types of programs and services are needed to keep these businesses competitive and in Los Angeles County[6].

The first step in developing and analyzing the survey was to determine the level of dependency on defense in the County's high technology complex and how many jobs are tied to defense work. This baseline was established through questions about firm size and percentage of total annual sales to the DoD. The data provide the basis for developing a reliable picture of the impact a shrinking defense budget can have on the County's work force.

After the direct dependency on defense by high technology industries was established, the secondary linkages to customers and suppliers were explored to understand second and third tier repercussions of shrinking defense revenue. By analyzing customer and supplier linkages the following information was derived:

- Level of dependence upon local suppliers and customers;
- Types of suppliers and customers required by the industry;
- Dollar amounts of major purchases and sales;
- Local supplier network strengths and weaknesses;
- Depth of multipliers within an industry; and
- New sources of materials and emerging markets.

Once the linkages between the high technology industries, the DoD, and local customers and suppliers were established, then the different factors that affect those linkages were examined:

- DoD contract projections,
- Firms' future plans regarding employment growth and relocation,
- Perception of local business environment,
- New products and services,
- Strategies for retaining competitiveness, and

[6]A copy of the survey instrument can be found at the end of this chapter.

- Technology transfer methods.

PROFILE OF THE RESPONSES

Survey responses reflected the industrial diversity of Los Angeles County's high technology complex as well as the dominant presence of aerospace. The high technology industrial core is made up of industries with high multiplier effects created by a substantial amount of subcontracting of components and assemblies.

- The aircraft parts industry sectors[7] dominated the survey response in both number of firms and employment.

- The electronics and electrical equipment sectors of the communications equipment industry also has a large number of firms, although with a few exceptions these are small employers.

- The measuring and controlling instruments industry was the third most frequently represented industry with emphasis on search and navigation equipment and laboratory apparatus. This industry sector also has a few very large firms and many small firms.

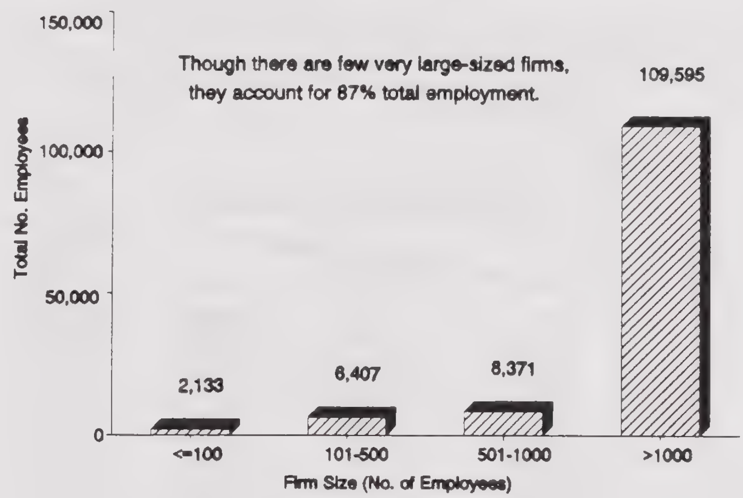
- Other significant industries included industrial and commercial machinery (including computer equipment), metal products, engineering/research and development, business services (systems architecting and computer-related services), chemicals, and durable wholesale.

The survey, with 126,506 employees represented, covers 51% of the County's total employment in the high technology sector[8]. Results from the survey indicate that the futures of a few large firms may well determine the near term future of the high technology industrial complex in Los Angeles County. The very large firms (with more than 1,000 employees) represented only 11% of the survey respondents, but 87% of the total employment or 109,595 employees (See Figure 1). The proportion of very large firms within the survey sample accurately reflects the composition of high technology industries within the County as a whole. The largest employers were found in aircraft, measuring instruments, electronics, and engineering/research and development - these were the only surveyed industries with more than 1,000 employees in some firms. Some of these very large firms have their corporate headquarters located outside of the County, weakening their ties to the area. Should these very large firms, or any significant portion of them, leave the local economy the results could be devastating.

[7] SIC 3724 Aircraft Engine and Engine Parts and SIC 3728 Aircraft Parts and Auxiliary Equipment.

[8] As of November 1991, EDD's high technology employment figure for Los Angeles County was 226,900. Employment in the EDD high technology industries for the survey was 115,146.

Figure 1 Total Employment by Firm Size



The rest of the firms responding to the survey were predominantly small. The median firm employment was 82 and 54% of the firms employ 100 or fewer people. Although small in employment numbers, these firms nonetheless are very significant for Los Angeles County. Relationships they have developed with the very large firms are one of the County's competitive advantages for retaining those crucial establishments. Smaller firms have more ties to the local economy, are very dynamic and are achieving significant diversification in order to compete in the region.

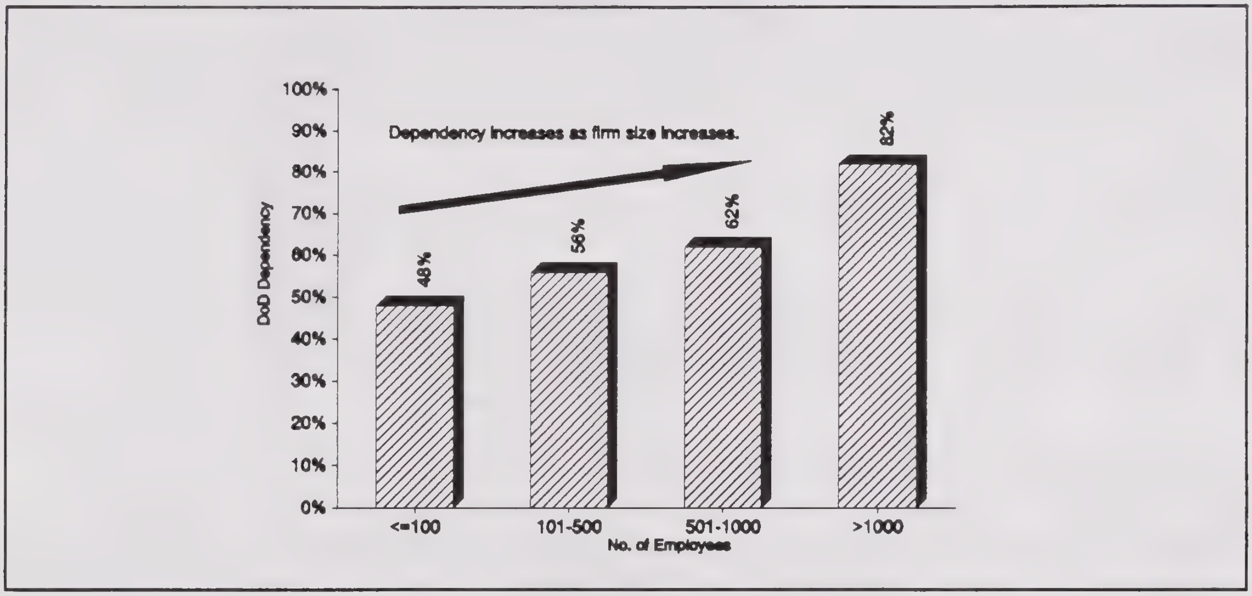
The survey successfully captured the major prime contractors in the County; the firms responding represented at least $19.8 billion in annual sales, with a median annual sales of $11 million. Most of the firms' customers are outside of the County (78%), representing approximately $16.6 billion brought into Los Angeles County. With high revenues and customers concentrated outside of the County, the defense-related firms are crucial to the local economy. Three industries stand out in terms of annual revenue: in the most recent fiscal year, average annual sales of firms in the aircraft industry were $413 million, sales of business service firms averaged $361 million and sales of measuring instruments firms averaged $334 million.

Defense Dependency

A definite trend emerged showing that the larger the firm, the greater the dependency upon the Department of Defense. The very large firms, whose employment is so crucial to the high technology industry, are for all intents and purposes one customer firms, and that customer is the Department of Defense. For these very large firms, the median level of defense dependency, established as the percentage of annual sales to the DoD, was 97%

(see Figure 2). In other words, approximately 109,595 jobs in Los Angeles County in this survey alone, and not including any multiplier effects, are directly dependent upon the DoD unless these industries find ways to diversify.

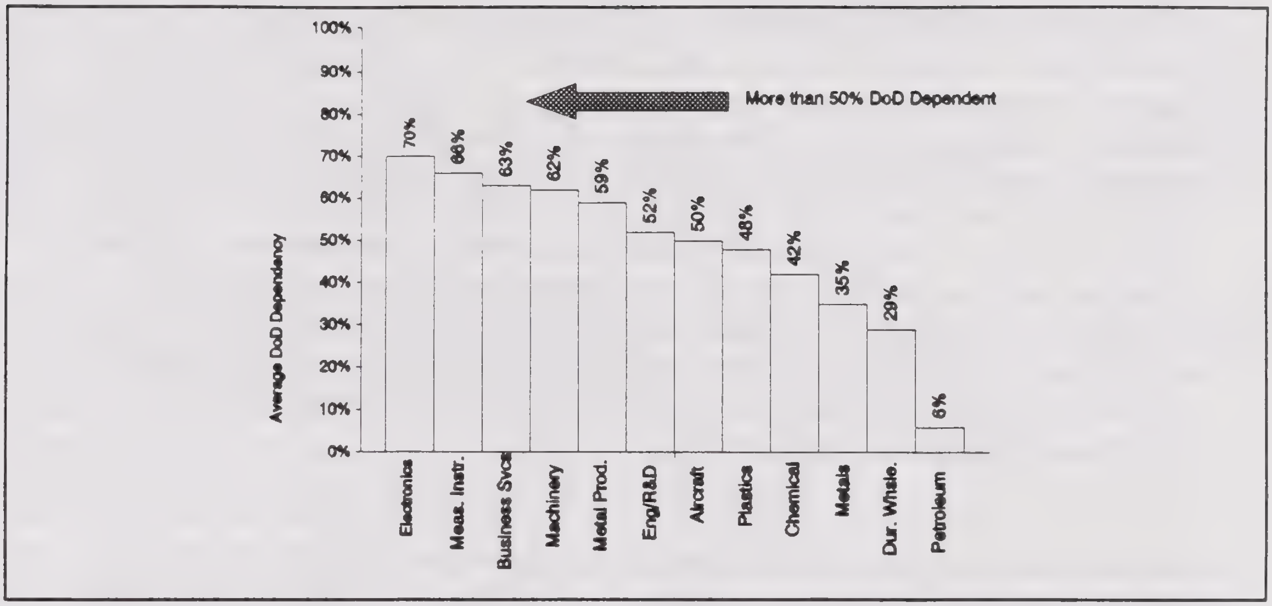
Figure 2 DoD Dependency by Firm Size



The smaller firms in the high technology industrial complex are much more diversified and less dependent on the DoD. The small firms (with 100 or fewer employees) depended on the DoD for an average 50% of their sales, the medium firms (101-500 employees) depended on the DoD for 60% of their sales, and the large firms (501-1000 employees) depend on the DoD for 65% of their sales. It is important to recognize that many small firms are also indirectly dependent upon the DoD because they have substantial ties with the very large, defense dependent firms. Unlike the larger defense dependent firms who have few plans to diversity, the smaller firms are working very hard to even further reduce their defense dependence.

By industry, the most defense dependent sectors in the high technology complex are electronics, measuring instruments, business services, machinery, metal products, and engineering/ research and development (See Figure 3). Aircraft averaged 50% dependency, which would seem to bode well for the industry, although both its defense and commercial markets are shrinking and becoming increasingly competitive. What is crucial to understand is that these industries hold Los Angeles County's concentration of talented workers and leading edge technology. Because of aerospace's extreme dependence upon the DoD, these strengths are at risk. Overall, 65% of those jobs in the high technology industrial complex are dependent upon DoD funding.

Figure 3 DoD Dependency by Industry



Department of Defense Contract Prospects

The need for diversification becomes even more evident as the prospects for DoD contracts in the next five years are examined. Firms were asked to list their top five DoD contracts for the next five years. Those projected contracts for all firms in the survey came to a total of $45.1 billion over the next five years, or $9 billion each year. Much of this projected work is on the B-2, the C-17, the F-18, missiles, and spares and upgrades.

Two issues emerge from these projections. The first is that the projections appear to be overly optimistic. Several of the programs listed by firms in their responses have since been cutback significantly by the federal government, e.g., the B-2. The County has approximately 4,000 DoD contractors who received approximately $9 billion in 1990[9]. Thus, the survey respondents indicated that they alone expect to bring in the same amount of DoD revenue as the total industry complex in the County during a time when defense budgets will continue to decline. Even with a significant amount of subcontracting from prime contractors outside of the County, these expectations seem unlikely.

The second issue is that the very large defense dependent firms together count on the DoD for 82% of their total annual sales, or $15.1 billion dollars. Future projections for the Federal defense budget are for further cutbacks and program cancellations. Although the defense budget is not going to disappear, it can no longer sustain Los Angeles County's high technology industrial complex as it has in the past. These firms, especially those highly dependent upon defense, must face the unavoidable changes in the defense budget and explore opportunities for diversification.

[9]Office of Economic Adjustment, Department of Defense. Los Angeles County DoD Awards for 1990.

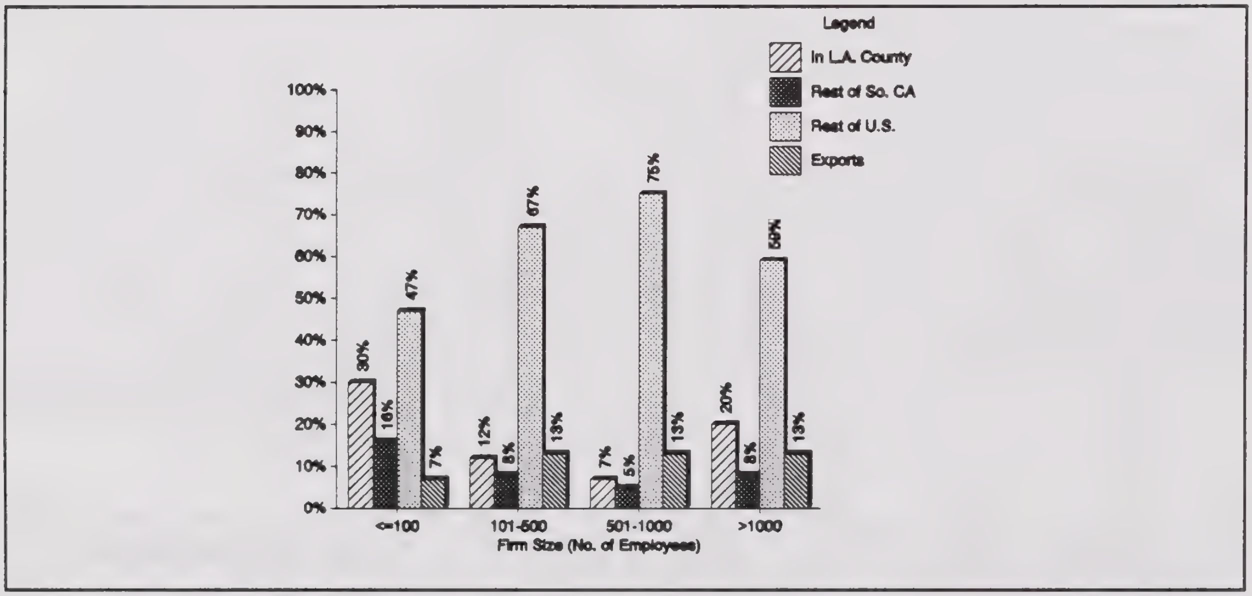
Customer and Supplier Networks

Customer networks

The high technology industrial complex is much more affected by national economic trends than local trends. Approximately 78% of the customers for the firms surveyed are located outside of Los Angeles County (See Figure 4). The concentration of customers outside of Los Angeles County has beneficial ramifications for the local economy. By having so many customers located outside of the County, these firms bring significant sales revenues into the County. Many of these firms' fortunes are not closely tied to the fate of a local economy that is currently experiencing a significant downturn. Thus, when the national economy picks up, those firms that are not heavily defense dependent should prosper and help bring along the local economy.

The linkage of these firms to national and global markets is an advantage for the local economy, but it is possible that these firms may find their linkage to the local economy a disadvantage. By competing on a national level for markets, many of these firms are facing inelastic price structures in highly competitive markets. Local costs added to their product, for example local licenses, taxes or regulatory compliance that their competitors do not

Figure 4 Customer Location by Firm Size



have to pay, may put local firms at a pricing disadvantage in the national market.

A few customers stand out as the primary markets for local firms. The most frequently mentioned customers for local firms are the Department of Defense, particularly the U.S. Air Force, followed by Boeing in Seattle/Wichita, McDonnell Douglas in St. Louis/Long Beach, and General Dynamics. All of these customers are notably dependent upon a

shrinking DoD budget, with the possible exception of Boeing. Such a high degree of local dependence upon this declining and unstable market should lead firms to reevaluate their plans and explore diversification. Until a decision to diversify into commercial markets is made there is little that local government can do to assist large local firms other than support their business efficiency so that they remain competitive for what is left of DoD contracts.

The very large firms were the least diversified in their customer base; on average they had 40 customers. And as was already discussed, for a majority of them, most of this narrow business base depends on the DoD. In contrast, the small firms had an average of 326 different customers, the medium firms had 268, and the large firms had 569 different customers. Again the very large firms, which hold the bulk of the employment base in the County, are in a very precarious position, dependent on a shrinking customer base.

Small firms were found to be the most dependent upon Los Angeles County customers (30%), followed by the very large firms (>1000 employees) with 20% of their customers in Los Angeles County (see Figure 4). The smaller firms' dependency on local customers can be explained by their limited marketing resources. The extent of the very large firms' local dependence is probably the result of subcontracting between the County's major prime contractors.

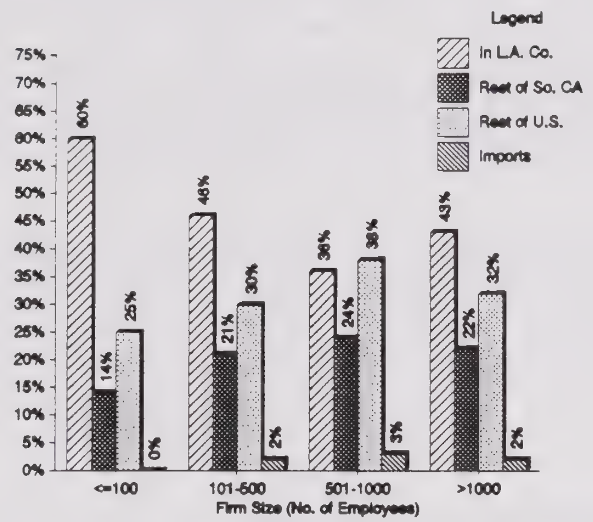
Exporting is significant as a source of revenue because it is a major market of the very large value-added firms. Small firms have not successfully tapped foreign markets although many have begun to explore the possibilities. The rest of Southern California excluding Los Angeles County did not play a large role as a source of customers. This information would suggest that the markets in San Diego, Orange, Ventura, and Santa Barbara County are partially untapped and may be worth further exploration.

Supplier networks

Because of its strong multiplier effects, the high technology industrial complex is important for the County's economic well-being. Most of the suppliers for the firms surveyed were located within Los Angeles County meaning that there are ripple benefits in the County's economy. The survey found however that as firm size decreases dependence upon local suppliers increases (see Figure 5). Similarly, as firm size increases dependence upon suppliers outside of Southern California and imports increases. The result is that although most of the suppliers are located within Los Angeles County, because the larger firms have more money to spend and make more purchases outside of the County, a majority of spending may still be out of the County.

Further evidence of the County's high technology linkages with the defense industry is provided by the finding that as DoD dependence increased so did use of Los Angeles County suppliers. Use of suppliers in the rest of Southern California also increased as defense dependence increased except for the most defense dependent (76-100%) firms.

Figure 5 Supplier Location by Firm Size



Despite criticism that offshore sourcing has diminished the U.S. role as a leader in high technology, the survey shows that only 2% of the respondents' suppliers were foreign. The only significant user of imports is the aircraft parts industry, which makes an average of 32% of its purchases from abroad, for an estimated $1.9 billion. In the case of the aircraft parts industry, this use of foreign suppliers can probably be attributed to offset agreements set up by the countries which are purchasing products from these firms.

Only two industries showed particularly strong ties to local suppliers. These were miscellaneous metal products (SIC 349), which bought 82% of its supplies from local firms, and machinery (SIC 35), which bought 69% of its supplies from local firms. Many second tier firms were very dependent upon a select few local metal producers. These linkages should be taken into account as environmental agencies weigh the economic contribution of these so called "dirty" industries against their environmental impacts.

BUSINESS ENVIRONMENT

Understanding local firms' perceptions of the Los Angeles County business environment is crucial for two reasons. The most obvious is a concern regarding business attraction and retention. Is the local business environment conducive to innovation, growth, and prosperity, or does it discourage business, creating incentives for firms to relocate? The second reason for surveying the business environment may be less obvious, though closely related to the first point. Does the business environment reduce the competitive edge of local industry? If the high technology industry sold all of its products to the local market, then the issue would not be so important because all competitors would be operating with similar handicaps and advantages. But if, as is the case with Los Angeles County's high technology firms, their market is global, then the handicaps of the local business environment must be outweighed by the advantages. For instance, if the local business

environment has a high level of taxation compared to a firm's other competitors in the national market, this firm may be at a competitive disadvantage. A local advantage, such as a uniquely highly-skilled labor force could outweigh the disadvantage.

The purpose of this part of the survey was to ascertain competitive advantages and disadvantages of the local business environment compared to other business environments. Employers were asked to rate the Los Angeles County business environment on 38 factors in 5 categories: Use of Local Suppliers/Subcontractors, Factors of Production, Environmental Regulations, State and Local Taxes, and Public Sector Support. The following scale was used:

Major strength of the Los Angeles County business environment
Competitive with other business environments
Neutral
A disadvantage to doing business in Los Angeles County
A deterrent to doing business in Los Angeles County

Responses from firms were weighted by their number of employees.

Table 1 at the end of this chapter provides detailed information about business climate responses.

Use of Local Suppliers/Subcontractors
Overall supplier availability and quality of suppliers were considered to be competitive with other business environments, while supplier prices were considered neutral. Miscellaneous metal products (SIC 349), electronic components (SIC 367), and aircraft and parts (SIC 3724) all viewed local suppliers and subcontractors to be a strength of area.

Factors of production
The factors of production were broken up into twenty items that come under the subheadings of labor, facilities and insurance. Overall the responses to factors of production were neutral. Firms in rubber (SIC 30), miscellaneous metal products (SIC 349), and aircraft and aircraft parts (SIC 3724) indicated that the factors of production in general were competitive with other business environments.

The skill levels of local managers, engineers, scientists, and the weather were identified as strengths of the County. Administrative, clerical, skilled and unskilled workers,natural resources, educational facilities, and cultural opportunities were rated as being competitive with other business environments. Los Angeles County was considered to be neutral regarding the costs of utilities and the availability of insurance coverage. On the other hand, the costs of insurance, wages and benefits, and commute to job were ranked as disadvantages. The cost of worker's compensation, housing, and real estate were seen as deterrents to doing business in Los Angeles County.

Environmental regulations
By far the biggest complaint by the businesses surveyed was the regulatory environment that exists in Los Angeles County. Environmental regulations were considered a competitive disadvantage by survey respondents. The following industries considered environment regulation a deterrent to doing business in Los Angeles County: petroleum refining, metals, metal products, and guided missiles. Even the service industries found the environmental regulations to be a disadvantage to being in Los Angeles County.

The most strenuous objection was to the bureaucratic difficulties in coming into compliance with air quality regulations, followed closely by the cost of air quality compliance and anticipated environmental regulations. These three factors were ranked as deterrents. The technical difficulties in complying with air quality and water quality regulations, the cost of water quality compliance, and the bureaucratic difficulty in complying with water quality regulations were considered to be less of a problem and were rated as disadvantages.

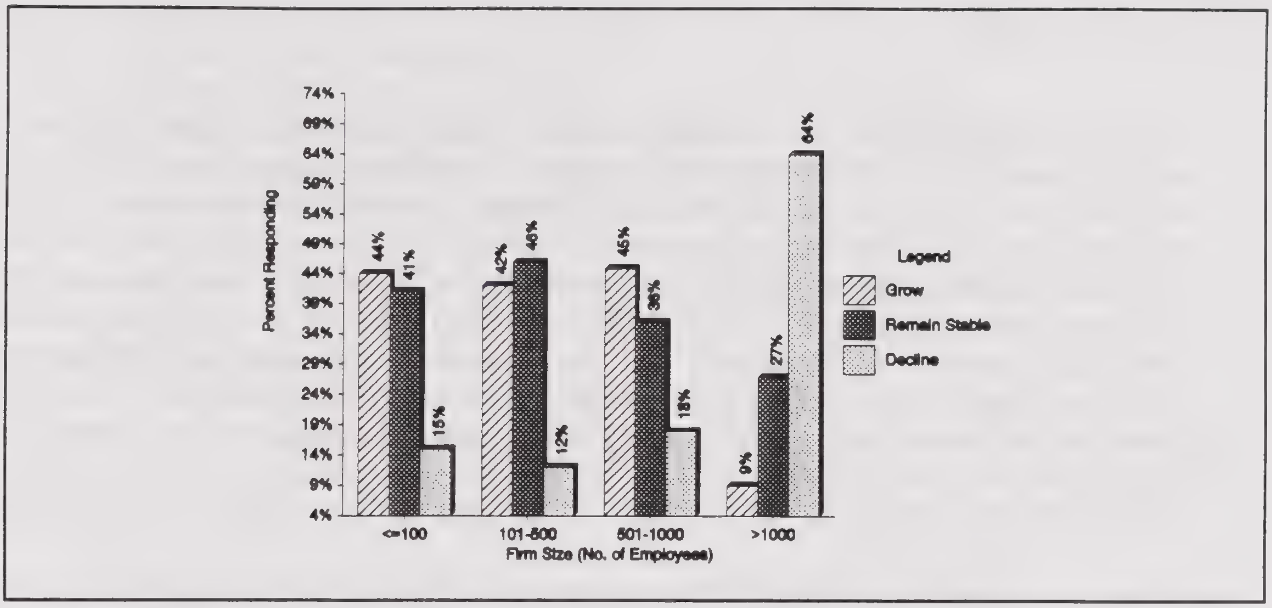
State & local taxes
Taxation has never been very popular, and local businesses rated property taxes, payroll taxes, income taxes, and licensing fees as a disadvantage in doing business in the area. Only the petroleum, aircraft and aircraft parts, and durable wholesale industries considered state and local taxes to be neutral factors of the local business environment. Metal products (SIC 349) and laboratory apparatus (SIC 382) industries found state & local taxes to be an actual deterrent.

Public sector support
Results from the survey show that public sector support from city, county, state, and federal representatives is less than desired and considered to be a disadvantage. The only industries rating public sector support differently were machinery, aircraft and aircraft parts, and aircraft engines and parts which ranked the support as neutral, and metals, guided missiles, and measuring instruments which consider lack of support by the public sector to be a deterrent to doing business locally.

Employment Projections

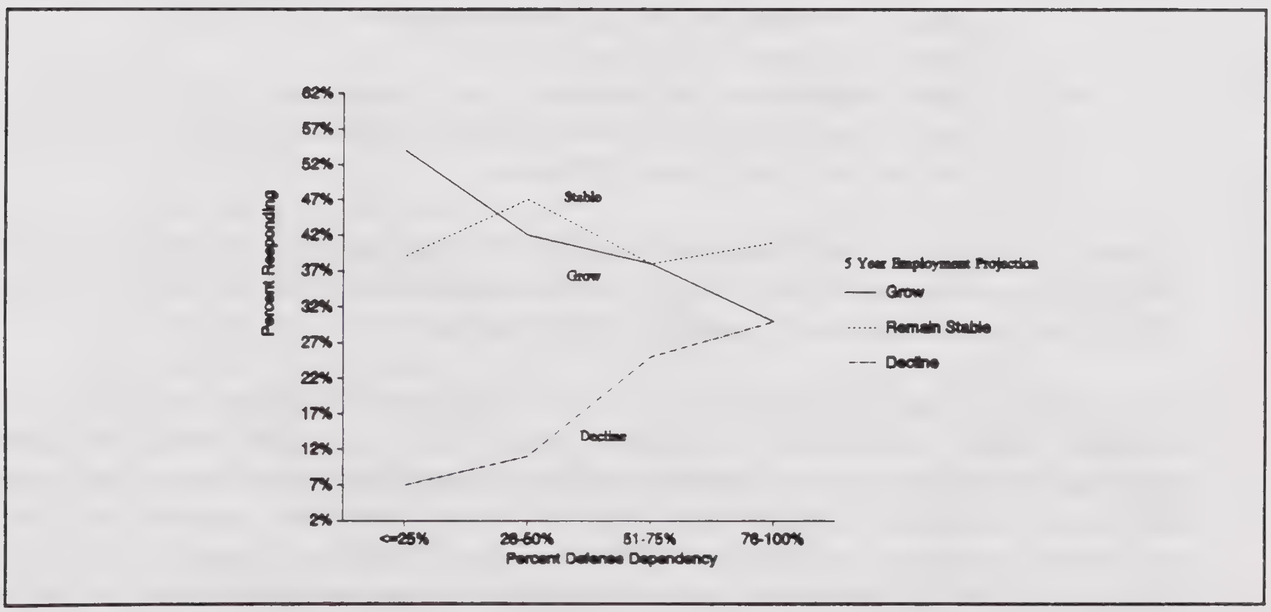
Firm projections for future employment prospects were quite positive among small and medium-sized firms and dismal among the very large firms (See Figure 6). Most firms were optimistic, with 40% anticipating growth and 40% predicting stability. Twenty percent said their employment would decline in the next five years. Forty-four percent of the smallest firms (100 employees or less), indicated their employment would grow. Many of these employers said that by August they had already made all of the cutbacks in staff possible and were just riding things out, hoping to grow again once the economy improved. The worst projections were from the very large firms. Only 9% of these firms anticipated their employment growing in the next five years and 64% anticipated a decline in employment over the next five years.

Figure 6 Five Year Employment Projections by Firm Size



Firms anticipating a decline in future employment are mostly those that are highly defense dependent (See Figure 7). Alternatively, those firms looking forward to employment growth are the less defense dependent, more diversified firms. Those industries in which

Figure 7 Correlation of Defense Dependence and Projected Employment Decline



most of the firms anticipated growth include chemical, metals, electronics, metal products, durable wholesale, business services, and aircraft. Of these industries only electronics and business services were 50% or more defense dependent. Industries generally anticipating

employment stability include machinery, measuring instruments and engineering/research and development.

In several industries there were clusters of firms whose projections varied from the overall industry outlook. Miscellaneous machinery (SIC 359), which is much more dependent upon the DoD than the rest of the machine industry, was much less optimistic regarding employment; 50% anticipated a decline in employment. Aircraft and aircraft parts (SIC 3724) and guided missiles (SIC 376) projected an overall growth in employment, 67% and 50% respectively, although 33% in guided missiles indicated that they anticipated their overall employment to decline in the next five years. Aircraft engine and engine parts (SIC 3728) was notably more conservative, with 54% anticipating employment would remain stable and 38% anticipating growth; only 8% expected employment to decline.

RELOCATION

Concerns expressed by local government and industry leaders about the possible exodus of firms from the County are well grounded and need to be acted upon. One-quarter of the firms surveyed indicated that they would be moving some or all of their employment in the next five years. This group of employers represents 61% of the total employment in the survey, translating into 76,174 jobs at risk. Among these firms anticipating relocation, there are 7 employers who account for 97% of the jobs to be relocated. Of these seven firms:

- 2 plan to stay within Los Angeles County
- 1 plans to relocate to Orange County
- 2 plan to relocate out-of-state
- 1 has yet to determine the site of its relocation
- 1 will follow USAF Space Division

By industry, some of those firms anticipating relocating some or all of their jobs include: 31% of the electronics industry, 50% of the aircraft engine and engine parts industry, and 38% of the aircraft parts and auxiliary equipment industry.

Of the firms planning to relocate, one-third anticipate reducing their workforce, one-third anticipate their employment remaining stable and one-third anticipate growth in employment. In laying out a business retention strategy, this split should be considered. The County would be well advised to focus its business retention resources on firms which are stable or growing. It would be wasteful to expend scarce resources on firms which are in permanent decline and whose jobs will disappear no matter what efforts are made by the County.

Firms planning to relocate ranked the following business environment factors as deterrents to doing business in Los Angeles County:

- Workers' Compensation
- Housing Costs
- Distance of Commute
- Real Estate Costs
- Insurance Costs
- Air Quality Compliance Costs and Bureaucracy
- Anticipated Environmental Regulations
- Income Taxes
- City and County Public Sector Support

Strategies for Retaining Competitiveness

In examining the strategies firms use to remain competitive in aerospace and high technology, it became evident that strategic information regarding markets, industry trends, diversification, and program implementation is key to competitiveness.

Most firms surveyed considered quality improvement programs to be very important for retaining a competitive edge in their industry. Many also identified the following as being very important strategies for competitiveness:

- Inventory Management
- New Product Development
- Product Improvement
- Expediting Product Development

Upgrading plant and equipment was considered to be important by most firms surveyed. Also considered important by many firms were:

- Just-In-Time Delivery
- Identifying New Markets for Existing Products
- Downsizing Workforce
- Increasing R&D Expenditures
- Market Forecasting
- Information Technology

Three items stood out as being not important to most firms as competitive strategies:

- Decreasing R&D Expenditures
- Relocation to Another Region
- Acquisitions/Mergers with Other Firms

Most firms rely on their in-house R&D staff (77%) and trade associations (54%) for upgrading manufacturing and services. Independent consultants (41%) were also used by many firms for upgrades. Some transfer of technology takes place between firms (25%).

Given Los Angeles County's rich research university climate, the university research programs were surprisingly under-utilized - only 16% of the firms surveyed made use of those facilities. This information suggests that university and interfirm linkages need to be strengthened.

RECOMMENDATIONS

Results from the survey suggest two complementary strategies would help the County retain its leadership in high technology. The first strategy is one of business retention efforts, directed particularly at the very large firms anticipating employment growth or stability. The second strategy is to assist the small, dynamic, and innovative firms as they struggle to compete in emerging high technology markets. To implement these strategies it is recommended that:

- The County update and fill gaps in its industry and labor market data. Information on industry trends, linkages, and impact is the key to timely responsiveness and assistance. It enables government to understand and assist a regional economy undergoing major restructuring. As indicated by firms in the survey, strategic information is crucial for them in retaining a competitive edge in their industries.

- Steps be taken to retain the large defense dependent industries and assist them in diversification efforts so that they might retain their viability. Assistance should range from streamlining the regulatory process to exploring technology commercialization possibilities.

- An environment be developed that nurtures the new wave of the high technology complex: small and innovative growth firms. Such an environment should include financial assistance, technical assistance, access to testing facilities, entrepreneurship training, and facilitating strategic alliances.

- A partnership between industry and local government be developed to improve mutual understanding and build a capacity to act on mutual goals. A theme throughout the survey responses is the impression of a local government uninterested in the fate of local industry. Steps toward building a positive relationship between the two sectors at a time when other out-of-state government officials are wooing local industry could be very fruitful.

- Technology transfer between firms and local university research programs be enhanced. Local research programs, on the cutting edge of technology, are abundant and survey responses show that this resource is very much under utilized. Interfirm technology transfer through strategic alliances should also be encouraged and facilitated.

SURVEY TABLES

TABLE 1

USE OF LOCAL SUPPLIERS/SUBCONTRACTORS (weighted)

SICs

Business Environment Factors	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
SUPPAVAIL	2.16	2.62	1.33	1.48	1.51	1.00	1.92	1.95	1.32	1.44	1.55	1.02	1.42	1.06	2.19	2.20	1.42	2.53	2.98	1.99	2.00	1.97
SUPPPRICE	2.64	4.00	2.83	3.00	2.21	1.88	2.39	2.11	2.38	1.99	2.29	1.99	3.28	3.23	3.93	3.94	3.19	2.86	2.85	2.11	2.10	2.79
SUPPQUALIT	2.53	3.00	2.83	2.12	2.18	1.00	1.98	2.01	2.16	1.78	2.12	2.00	2.23	2.57	2.20	2.20	2.43	2.34	2.71	2.11	2.10	2.36
OVERALL	2.44	3.21	2.33	2.20	1.97	1.29	2.10	2.02	1.95	1.73	1.99	1.67	2.31	2.29	2.78	2.78	2.35	2.58	2.85	2.07	2.07	2.37

FACTORS OF PRODUCTION (weighted)

SICs

Business Environment Factors	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
MGRS	1.49	2.00	1.17	2.00	2.77	1.62	1.97	2.01	1.31	1.27	1.57	1.01	1.52	1.11	1.44	1.44	1.92	1.70	1.31	2.00	2.00	1.73
ENGINEERS	1.48	1.31	1.17	2.00	2.01	1.26	1.92	1.99	1.46	1.56	1.04	1.02	1.37	1.06	1.09	1.08	1.71	1.81	1.59	1.13	1.13	1.50
ADMIN	1.85	2.00	1.17	2.00	3.04	1.84	2.01	2.04	2.06	1.81	1.60	1.02	2.02	1.15	1.46	1.46	1.90	3.18	1.59	2.86	2.87	2.07
SKILLED	1.49	2.31	1.17	2.00	2.20	2.41	2.18	2.04	1.67	1.29	2.80	1.01	2.02	2.00	2.02	2.02	2.33	3.00	2.68	2.00	2.00	2.13
UNSKILLED	1.55	1.62	1.00	1.12	2.34	1.00	2.05	2.04	2.29	2.54	2.42	1.03	2.79	2.56	2.26	2.26	2.14	4.58	2.92	2.00	2.00	2.18
WAGES	4.00	2.00	3.67	3.12	4.06	3.91	4.09	4.04	3.31	2.49	3.57	1.90	3.74	4.45	3.83	3.82	4.27	3.62	3.73	2.22	2.20	3.43
BENEFITS	3.27	1.69	4.67	3.12	4.67	3.91	4.03	3.98	3.52	2.94	3.71	2.19	3.71	4.84	4.00	4.00	4.24	3.40	3.60	2.21	2.20	3.49
WORKMANCOM	4.64	2.00	4.50	5.00	4.70	3.91	4.12	4.04	4.16	3.38	4.28	2.18	4.31	5.00	4.80	4.80	4.35	4.48	3.90	4.04	4.04	4.22
HOUSING	4.84	5.00	4.83	5.00	4.13	4.53	4.14	4.05	4.73	4.49	4.79	4.28	4.64	4.89	5.00	5.00	4.58	4.09	4.65	4.90	4.90	4.67
WEATHER	1.46	1.62	1.00	1.00	1.45	1.00	1.90	1.97	1.22	1.23	1.02	1.02	1.37	1.01	1.03	1.02	1.97	2.14	1.00	1.13	1.14	1.33
NATRESOURC	2.02	1.62	1.00	2.88	2.91	1.62	3.77	3.85	2.45	2.22	2.37	1.02	3.01	2.24	1.30	1.28	3.65	2.88	2.38	1.99	2.00	2.30
EDUCATION	2.73	2.31	1.33	2.76	3.04	1.62	2.22	2.08	2.24	2.40	2.87	1.59	2.03	1.67	1.30	1.28	3.06	3.13	3.48	1.13	1.13	2.38
CULTURAL	1.53	2.62	1.00	1.88	2.97	1.62	2.07	2.02	2.02	1.75	1.71	1.30	1.85	1.39	1.27	1.26	2.53	2.88	1.56	1.14	1.14	1.89
COMMUTE	4.89	4.69	1.33	4.00	4.19	3.91	4.09	4.00	4.59	4.22	4.82	4.70	4.59	4.56	2.77	2.76	4.49	3.86	4.67	4.90	4.90	4.07
REALESTATE	4.48	5.00	4.50	5.00	4.11	2.97	4.14	4.05	3.58	3.66	4.67	4.27	3.64	4.52	4.24	4.24	4.46	4.13	4.94	4.03	4.03	4.40
WATER	3.56	2.93	3.00	3.00	3.85	1.67	3.87	4.03	3.26	2.99	3.61	4.24	3.55	4.46	4.00	4.00	3.65	2.78	3.00	3.03	3.03	3.32
ELECTRICIT	3.26	2.93	3.00	3.00	3.85	1.67	3.89	4.04	3.19	3.27	2.74	2.85	3.19	4.46	3.80	3.80	3.54	3.15	3.00	3.03	3.03	3.24
GAS	3.16	2.93	3.00	3.00	3.85	1.67	3.81	3.97	2.87	2.76	2.60	2.29	3.19	4.46	3.79	3.80	3.00	2.78	3.00	3.03	3.03	3.15
INSCOVER	2.49	2.00	2.83	3.12	3.41	3.23	3.02	3.06	2.93	2.29	2.15	1.73	3.60	2.71	3.07	3.06	4.13	2.92	3.29	4.75	4.76	3.00
INSCOST	4.11	4.00	3.17	4.88	4.08	4.15	3.95	4.06	4.50	4.23	3.92	3.29	3.72	4.56	3.25	3.24	4.35	4.45	3.89	4.76	4.76	4.08
OVERALL	2.92	2.63	2.43	2.99	3.38	2.48	3.16	3.17	2.87	2.64	2.91	2.20	2.99	3.16	2.79	2.78	3.31	3.25	3.01	2.81	2.82	2.93

TABLE 1 (Con't)

ENVIRONMENTAL REGULATIONS (weighted)

Business Environment Factors	SICs																					
	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
AQCOST	3.53	5.00	4.83	5.00	4.70	4.53	4.12	4.06	4.60	4.23	4.94	4.98	4.34	4.90	4.20	4.20	4.41	3.74	3.87	4.09	4.10	4.39
AQTECH	3.37	5.00	4.67	5.00	4.72	4.76	4.04	4.03	4.24	4.44	4.26	4.41	3.86	4.89	3.98	3.98	4.29	3.74	3.32	3.99	4.00	4.19
AQBUREAUCR	4.26	5.00	4.67	5.00	4.72	4.76	4.04	4.06	4.59	4.24	4.89	4.98	4.36	4.61	4.00	4.00	4.29	4.13	4.44	4.86	4.86	4.55
WQCOST	3.00	5.00	3.00	4.00	4.70	4.38	3.93	4.05	3.45	2.96	3.23	2.32	3.72	4.84	4.17	4.18	3.54	3.00	3.29	4.09	4.10	3.74
WQTECH	3.38	5.00	3.00	4.88	3.48	4.38	3.88	4.02	3.16	2.93	2.64	2.31	3.75	4.51	3.97	3.98	3.54	3.00	3.32	3.99	4.00	3.64
WQBUREAUCR	4.27	5.00	3.00	4.88	4.11	4.76	3.90	4.05	4.04	4.00	3.69	2.32	4.04	4.52	3.82	3.82	3.65	3.00	3.32	3.99	4.00	3.92
ANTICIPREG	3.54	5.00	3.00	5.00	4.84	4.76	4.01	4.06	4.45	3.97	4.94	4.98	4.31	4.89	4.20	4.20	3.87	3.84	3.89	4.00	4.00	4.23
OVERALL	3.62	5.00	3.74	4.82	4.47	4.62	3.99	4.05	4.08	3.83	4.09	3.76	4.05	4.74	4.05	4.05	3.94	3.49	3.63	4.15	4.15	4.09

STATE & LOCAL TAXES (weighted)

Business Environment Factors	SICs																					
	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
PROP_TAX	3.42	3.31	3.83	4.12	3.16	3.82	4.03	4.05	3.81	3.98	3.66	2.73	3.89	3.90	3.77	3.76	4.21	3.52	4.39	3.13	3.14	3.68
PAYROLLTAX	3.61	3.31	3.00	3.24	4.60	3.79	4.06	4.00	3.28	3.22	3.13	2.72	3.65	3.90	3.77	3.76	4.27	3.25	4.39	3.03	3.03	3.56
INCOME_TAX	4.45	3.00	3.00	3.24	4.70	4.10	4.05	4.00	3.90	3.69	4.08	3.99	3.65	4.52	4.12	4.12	4.38	3.39	4.25	3.03	3.03	3.77
LICENSES	3.20	3.69	3.83	4.88	4.69	3.92	4.03	4.05	4.32	4.70	3.87	3.56	3.60	3.99	3.92	3.92	4.13	3.49	3.29	4.87	4.86	4.01
OVERALL	3.67	3.33	3.42	3.87	4.29	3.91	4.04	4.02	3.83	3.90	3.69	3.25	3.70	4.08	3.89	3.89	4.25	3.41	4.08	3.52	3.52	3.75

PUBLIC SECTOR SUPPORT (weighted)

Business Environment Factors	SICs																					
	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
CITY	3.45	5.00	3.83	3.00	4.08	3.88	3.04	3.08	3.52	2.92	3.72	2.88	2.93	4.18	4.83	4.83	3.93	3.95	3.87	3.87	3.87	3.84
COUNTY	3.65	3.00	3.83	4.76	4.08	3.88	2.46	2.17	3.46	3.46	2.70	2.87	3.51	4.13	4.47	4.48	3.93	3.95	3.87	3.01	3.00	3.60
STATE	3.81	4.00	3.83	4.88	3.95	4.50	2.41	2.11	3.66	3.43	3.45	3.57	3.75	4.46	4.29	4.30	3.46	3.70	4.41	3.87	3.87	3.86
FEDERAL	3.81	4.00	3.83	4.88	3.85	3.26	2.36	2.11	3.69	3.94	3.27	2.87	3.38	4.46	4.47	4.48	3.46	3.70	4.12	3.00	3.00	3.75
OVERALL	3.68	4.00	3.83	4.38	3.99	3.88	2.57	2.37	3.58	3.44	3.28	3.05	3.39	4.31	4.52	4.52	3.69	3.82	4.07	3.44	3.43	3.76

1.0–1.8 STRENGTH; 1.81–2.61 COMPETITIVE; 2.62–3.41 NEUTRAL; 3.42–4.21 DISADAVANTAGE; 4.22–5.00 DETERRENT.

TABLE 1 (Con't)

USE OF LOCAL SUPPLIERS/SUBCONTRACTORS (unweighted)

Business Environment Factors	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
SUPPAVAIL	2.20	3.00	2.00	3.00	2.00	1.00	1.44	1.40	1.38	1.38	1.34	1.33	1.31	1.33	1.73	2.17	1.20	2.40	2.80	1.67	1.80	1.80
SUPPPRICE	2.80	4.00	2.50	3.00	2.44	1.67	3.56	3.20	2.31	2.25	2.76	1.83	3.15	2.67	3.55	4.00	3.00	2.60	2.80	2.67	2.60	2.83
SUPPQUALIT	2.40	3.00	2.50	2.50	2.33	1.00	1.78	2.00	1.94	1.88	2.21	2.00	2.15	2.17	2.73	2.83	2.60	2.00	2.60	2.50	2.40	2.26
OVERALL	2.47	3.33	2.33	2.83	2.26	1.22	2.26	2.20	1.88	1.83	2.10	1.72	2.21	2.06	2.67	3.00	2.27	2.33	2.73	2.28	2.27	2.30

FACTORS OF PRODUCTION (unweighted)

Business Environment Factors	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
MGRS	2.00	2.00	1.50	2.00	2.44	1.33	2.00	2.00	1.63	1.63	1.69	1.17	1.85	1.50	2.09	1.83	2.40	1.75	1.80	2.17	2.20	1.86
ENGINEERS	1.80	1.50	1.50	2.00	2.00	1.33	1.71	2.00	1.56	1.63	1.67	1.33	1.83	1.40	1.82	1.50	2.20	1.67	2.00	1.50	1.60	1.69
ADMIN	2.00	2.00	1.50	2.00	2.75	1.50	2.25	2.25	2.07	2.00	2.04	1.50	2.33	1.67	2.09	2.00	2.20	2.25	2.00	2.20	2.25	2.04
SKILLED	2.00	2.50	1.50	2.00	2.44	2.33	2.67	2.40	1.88	1.75	2.14	1.33	2.33	1.83	2.36	2.00	2.80	3.00	2.40	1.83	1.80	2.16
UNSKILLED	1.80	2.00	1.00	1.50	2.33	1.00	2.11	2.20	2.08	2.00	2.29	1.83	2.67	2.00	2.45	2.50	2.40	3.00	2.67	2.20	2.25	2.11
WAGES	4.00	2.00	3.00	3.50	3.56	3.33	4.00	4.20	3.81	3.75	3.52	3.33	3.38	3.67	3.91	3.67	4.20	3.80	3.80	3.17	3.00	3.55
BENEFITS	3.60	1.50	4.00	3.50	3.67	3.33	3.67	3.60	3.75	3.63	3.79	3.67	3.62	4.00	3.91	3.67	4.20	3.75	3.80	2.83	2.80	3.54
WORKMANCOM	4.80	2.00	3.50	5.00	3.89	3.33	4.22	4.20	4.31	4.00	4.28	3.67	4.08	5.00	4.27	4.17	4.40	4.40	4.20	4.00	3.75	4.07
HOUSING	4.80	5.00	4.50	5.00	3.78	3.67	4.56	4.60	4.81	4.88	4.48	4.17	4.54	4.67	4.91	5.00	4.80	4.00	4.00	4.50	4.40	4.53
WEATHER	1.40	2.00	1.00	1.00	1.78	1.00	1.44	1.40	1.38	1.25	1.31	1.67	1.31	1.17	1.73	1.17	2.40	2.40	1.00	1.83	2.00	1.51
NATRESOURC	2.40	2.00	1.00	2.50	2.33	1.33	2.56	2.00	2.31	2.38	2.41	1.67	2.85	2.00	2.64	1.83	3.60	3.00	2.20	1.83	2.00	2.23
EDUCATION	2.40	2.50	2.00	2.00	2.44	1.33	2.67	2.80	2.25	2.38	2.17	2.17	2.23	1.50	2.45	2.00	3.00	3.20	2.60	1.50	1.60	2.25
CULTURAL	1.40	3.00	1.00	1.50	2.44	1.33	2.11	2.20	2.13	2.38	1.97	1.67	2.08	1.67	2.18	1.83	2.60	3.00	1.60	2.00	2.20	2.01
COMMUTE	4.60	4.50	2.00	4.00	4.00	3.33	4.33	4.20	4.56	4.38	4.31	4.33	4.54	4.00	4.27	4.00	4.60	3.60	4.20	4.50	4.40	4.13
REALESTATE	4.20	5.00	3.50	5.00	3.80	2.67	4.67	4.60	4.00	4.14	4.39	4.00	4.67	4.17	4.64	4.67	4.60	4.20	4.40	4.17	4.20	4.27
WATER	3.60	3.50	3.00	3.00	2.90	1.33	3.56	3.80	3.31	2.75	3.34	3.17	3.38	3.50	3.73	3.83	3.60	3.00	3.00	3.33	3.40	3.24
ELECTRICIT	3.40	3.50	3.00	3.00	2.90	1.33	3.78	4.20	3.06	2.75	3.24	2.83	3.31	3.67	3.45	3.50	3.40	3.20	3.00	3.33	3.40	3.20
GAS	3.20	3.50	3.00	3.00	2.90	1.33	3.22	3.40	2.94	2.63	3.21	2.67	3.31	3.67	3.27	3.50	3.00	3.00	3.00	3.33	3.40	3.07
INSCOVER	3.00	2.00	2.50	3.50	3.50	3.33	3.33	3.40	3.06	2.63	2.90	2.17	3.38	2.67	3.45	3.00	4.00	2.80	3.40	3.67	3.80	3.12
INSCOST	4.40	4.00	3.50	4.50	4.00	3.67	4.44	4.80	4.44	4.38	3.86	3.50	3.92	4.33	4.00	3.67	4.40	4.20	4.20	3.83	3.80	4.09
OVERALL	3.04	2.80	2.38	2.98	2.99	2.16	3.16	3.21	2.97	2.86	2.95	2.59	3.08	2.90	3.18	2.97	3.44	3.16	2.96	2.89	2.91	2.93

TABLE 1 (Con't)

ENVIRONMENTAL REGULATIONS (weighted)

Business Environment Factors	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
AQCOST	4.00	5.00	4.50	5.00	4.00	3.67	4.56	4.80	4.53	4.43	4.41	4.50	4.23	4.50	4.36	4.33	4.40	3.75	3.80	3.80	4.00	4.31
AQTECH	3.80	5.00	4.00	5.00	4.22	4.33	4.63	4.60	4.20	4.43	3.90	3.83	3.85	4.17	3.82	3.50	4.20	3.75	3.60	3.60	3.75	4.10
AQBUREAUCR	4.40	5.00	4.00	5.00	4.22	4.33	4.63	4.80	4.53	4.57	4.45	4.50	4.38	4.17	4.09	4.00	4.20	4.00	4.20	4.00	4.00	4.36
WQCOST	3.60	5.00	3.00	4.00	4.00	3.67	4.25	4.60	3.73	3.57	3.66	3.33	3.62	3.83	3.73	4.00	3.40	3.00	3.40	3.80	4.00	3.77
WQTECH	4.00	5.00	3.00	4.50	3.78	3.67	4.13	4.40	3.53	3.43	3.52	3.17	3.62	3.67	3.55	3.67	3.40	3.00	3.60	3.60	3.75	3.71
WQBUREAUCR	4.60	5.00	3.00	4.50	4.11	4.33	4.25	4.60	3.93	4.00	3.83	3.33	3.92	3.83	3.64	3.67	3.60	3.00	3.60	3.60	3.75	3.91
ANTICIPREG	4.20	5.00	3.00	5.00	4.44	4.33	4.44	4.80	4.53	4.57	4.45	4.50	4.38	4.33	4.09	4.17	4.00	3.80	4.00	3.80	3.75	4.27
OVERALL	4.09	5.00	3.50	4.71	4.11	4.05	4.41	4.66	4.14	4.14	4.03	3.88	4.00	4.07	3.90	3.90	3.89	3.47	3.74	3.74	3.86	4.06

STATE & LOCAL TAXES (unweighted)

Business Environment Factors	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
PROP_TAX	3.00	3.50	3.50	4.50	3.50	3.00	4.11	4.60	3.75	3.75	3.69	3.00	4.08	3.67	3.91	3.67	4.20	3.60	3.80	3.80	4.00	3.74
PAYROLLTAX	3.40	3.50	3.00	4.00	3.80	3.33	4.22	4.20	3.50	3.38	3.38	2.83	3.77	3.50	3.91	3.67	4.20	3.20	3.80	3.60	3.75	3.62
INCOME_TAX	4.20	3.00	3.00	4.00	3.90	3.33	4.00	4.20	3.88	3.75	3.79	3.67	3.77	3.83	4.18	4.00	4.40	3.40	3.80	3.60	3.75	3.78
LICENSES	3.60	3.50	3.50	4.50	4.00	3.33	4.11	4.60	4.00	4.14	3.66	3.33	3.69	3.67	3.82	3.67	4.00	3.40	3.40	4.20	4.00	3.82
OVERALL	3.55	3.38	3.25	4.25	3.80	3.25	4.11	4.40	3.78	3.75	3.63	3.21	3.83	3.67	3.95	3.75	4.20	3.40	3.70	3.80	3.88	3.74

PUBLIC SECTOR SUPPORT (unweighted)

Business Environment Factors	28	29	30	33	34	349	35	359	36	367	37	3724	3728	376	38	3812	382	50	73	87	8731	OVERALL
CITY	4.00	5.00	3.50	3.00	4.00	3.67	3.56	4.00	3.71	3.57	3.55	3.83	3.15	3.67	3.73	3.33	4.20	3.60	3.80	3.40	3.25	3.69
COUNTY	4.00	3.00	3.50	4.00	4.00	3.67	4.11	4.00	3.79	3.86	3.69	3.67	3.77	3.50	3.55	3.00	4.20	3.60	3.80	3.20	3.00	3.66
STATE	4.20	4.00	3.50	4.50	3.89	4.00	3.89	3.60	3.79	3.71	3.79	4.00	4.00	3.67	3.36	3.17	3.60	3.40	4.00	3.40	3.25	3.75
FEDERAL	3.40	4.00	3.50	4.50	3.44	3.33	3.56	3.60	3.79	3.86	3.48	3.83	3.38	3.67	3.55	3.50	3.60	3.40	3.60	2.80	2.50	3.54
OVERALL	3.90	4.00	3.50	4.00	3.83	3.67	3.78	3.80	3.77	3.75	3.63	3.83	3.58	3.63	3.55	3.25	3.90	3.50	3.80	3.20	3.00	3.66

1.0–1.8 STRENGTH; 1.81–2.61 COMPETITIVE; 2.62–3.41 NEUTRAL; 3.42–4.21 DISADAVANTAGE; 4.22–5.00 DETERRENT.

TABLE 2

Findings for the ATF survey.

Survey Profile

Total # of firms	104
Total employment	126,506
Average employment	1,216
Median employment	82

Total annual sales	$19,763,564,000
Average annual sales	$208,037,516
Median annual sales	$12,000,000

Average percent of total annual sales manufactured for DoD	54%
Average DoD dependency weighted by employment	65%

Avg. % sales off the shelf	20%
Avg. % sales subcontracted	27%
Avg. % of sales custom products	34%
Avg. % of sales other	20%

Avg. % of customers in L.A. County	21.77%
Avg. % of customers in So. CA	11.66%
Avg. % of customers in U.S.	55.76%
Avg. % of exports	9.81%

Avg. % of suppliers in L.A. County	49.43%
Avg. % of suppliers in So. CA	16.60%
Avg. % of suppliers in U.S.	27.70%
Avg. % of imports	1.88%

SIC DESCRIPTIONS

282 Plastic Materials & Synthetic Resins
286 Industrial Organic Chemicals
299 Misc. Products of Petroleum & Coal
308 Misc. Plastic Products
335 Nonferrous Materials
336 Nonferrous Foundaries
344 Fabricated Structural Metal Prod.
345 Screw Machine Products
348 Ordnance & Accessories
349 Misc. Fabricated Metal Products
351 Engines & Turbines
353 Construction
354 Metalworking Machinery & Equip.
355 Special Industrial Machinery, except Metalworking
356 General Industrial Machinery & Equip.
357 Computer & Office Equipment
359 Misc. Industrial & Commc'l Machinery & Equip
362 Electrical Industrial Apparatus
365 Household Audio & Video Equipment
366 Communication Equipment
367 Electronic Components & Accessories
369 Misc. Electrical Machinery, Equip. & Supplies
371 Motor Vehicles & M.V. Equip.
372 Aircraft & Parts
3724 Aircraft Engine & Engine Parts
3728 Aircraft Parts & Auxilliary Equipment
373 Ship & Boat Building & Repairing
376 Guided Missiles & Space Vehicles & Parts
381 Search, Detection, Navigation, Systems & Equipment
382 Laboratory Apparatus & Analytical, Optical Measuring Instruments
507 Hardware & Plumbing, Wholesale
508 Machinery, Equipment & Supplies, Wholesale
734 Service to Dwellings, Buildings
737 Computer Programming
871 Engineering Services
873 Research, Development & Testing
8731 R&D, Physical and Biological

TABLE 3

SURVEY DATA BY FIRM SIZE

Firm Size (No. of Employees)	Distribution of Firms	Share of Employment	Total Employment	Overall
<=100	54%	2%	2,133	56
101-500	25%	5%	6,407	26
501-1000	11%	7%	8,371	11
>1000	11%	87%	109,595	11
Total	100%	100%	126,506	104

Employment Projections	Firm Size (No. of Employees)			
	<100	101-500	501-1000	>1000
Grow	44%	42%	45%	9%
Stable	41%	46%	36%	27%
Decrease	15%	12%	18%	64%
Total	100%	100%	100%	100%

Customer Location	Firm Size (No. of Employees)			
	<=100	101-500	501-1000	>1000
LA Co	30%	12%	7%	20%
So CA	16%	8%	5%	8%
In U.S.	47%	67%	75%	59%
Exports	7%	13%	13%	13%
Total	100%	100%	100%	100%

Supplier Location	Firm Size (No. of Employees)			
	<=100	101-500	501-1000	>1000
LA. Co	60%	46%	36%	43%
So. CA	14%	21%	24%	22%
In U.S.	25%	30%	38%	32%
Imports	0%	2%	3%	2%
Total	100%	100%	100%	99% *

*Some firms claimed to have no suppliers, particularly research firms.

SIC	Firm Size (No. of Employees)			
	<100	101-500	501-1000	>1000
28	20%	80%	0%	0%
29	100%	0%	0%	0%
30	100%	0%	0%	0%
33	50%	50%	0%	0%
34	60%	30%	10%	0%
349	100%	0%	0%	0%
35	90%	0%	10%	0%
359	80%	0%	20%	0%
36	38%	25%	25%	13%
367	50%	13%	25%	13%
37	41%	28%	14%	17%
3724	33%	33%	0%	33%
3728	46%	38%	15%	0%
376	33%	0%	33%	33%
38	55%	9%	9%	27%
3812	33%	0%	17%	50%
382	80%	20%	0%	0%
50	100%	0%	0%	0%
73	40%	60%	0%	0%
87	50%	33%	0%	17%
8731	40%	40%	0%	20%
Total	53%	25%	11%	11%

Firm Size (No. of Emp.)	Percent of Total Sales
<=100	2%
101-500	14%
501-1000	5%
>1000	79%

TABLE 4

SURVEY DATA ON DEFENSE DEPENDENCY

%Sales to DoD	Distribution of Firms
<=25%	27%
26-50%	20%
51-75%	16%
76-100%	37%

Firm Size	DoD Dependence by Firm Size	
(No. of Emp.)	Average	Median
<=100	57%	50%
101 - 500	55%	56%
501 - 1000	41%	65%
>1000	58%	97%

	DoD Dependency				
SIC	<=25%	26-50%	51-75%	76-100%	Overall Avg
28	60%	0%	0%	40%	42%
29	100%	0%	0%	0%	6%
30	50%	0%	0%	50%	48%
33	0%	100%	0%	0%	35%
34	22%	22%	22%	33%	59%
349	33%	33%	0%	33%	52%
35	10%	10%	50%	30%	62%
359	0%	0%	60%	40%	71%
36	19%	6%	19%	56%	70%
367	13%	13%	25%	50%	71%
37	31%	24%	10%	34%	50%
3724	50%	0%	0%	50%	56%
3728	31%	31%	15%	23%	44%
376	17%	17%	17%	50%	63%
38	10%	30%	20%	40%	66%
3812	0%	20%	20%	60%	80%
382	20%	40%	20%	20%	52%
50	60%	20%	0%	20%	29%
73	20%	20%	0%	60%	63%
87	33%	17%	17%	33%	52%
8731	40%	0%	20%	40%	52%

Firm Size	DoD Dependency			
(No. of Emp.)	<=25%	26-50%	51-75%	76-100%
<=100	64%	70%	50%	39%
101 - 500	25%	20%	25%	29%
501 - 1000	7%	5%	25%	11%
>1000	4%	5%	0%	21%
Overall	100%	100%	100%	100%

Firm Size	DoD Dependency				
(No. of Emp.)	<=25%	26-50%	51-75%	76-100%	Overall
<=100	33%	25%	15%	27%	100%
101 - 500	27%	15%	15%	42%	100%
501 - 1000	18%	9%	36%	36%	100%
>1000	10%	10%	0%	80%	100%

Projected	DoD Dependency			
Employment	<=25%	26-50%	51-75%	76-100%
Grow	54%	42%	38%	30%
Stable	39%	47%	38%	41%
Decrease	7%	11%	25%	30%
Overall	100%	100%	100%	100%

Projected	DoD Dependency				
Employment	0-25%	26-50%	51-75%	76-100%	Total
Grow	38%	20%	15%	28%	100%
Stable	27%	22%	15%	37%	100%
Decrease	11%	11%	21%	58%	100%

TABLE 5

SURVEY DATA ON CUSTOMER & SUPPLIER LOCATIONS

SIC by Customer Location

SIC	Average % of Customers				
	In L.A. Co.	In So. CA	In U.S.	Exports	Total
28	8%	12%	53%	27%	100%
29	8%	15%	65%	13%	100%
30	70%	25%	4%	1%	100%
33	15%	19%	50%	16%	100%
34	28%	18%	45%	10%	100%
349	38%	17%	38%	8%	100%
35	35%	11%	54%	1%	100%
359	25%	6%	68%	1%	100%
36	14%	13%	59%	14%	100%
367	22%	12%	55%	12%	100%
37	14%	10%	68%	9%	100%
3724	3%	6%	86%	5%	100%
3728	13%	11%	71%	5%	100%
376	19%	9%	62%	10%	100%
38	12%	8%	66%	14%	100%
3812	9%	6%	70%	16%	100%
382	15%	11%	62%	12%	100%
50	52%	22%	20%	6%	100%
73	38%	8%	52%	3%	100%
87	35%	2%	55%	9%	100%
8731	40%	0%	60%	0%	100%
Overall	22%	12%	56%	10%	100%

SIC by Supplier Location

SIC	Average % of Suppliers				
	In L.A. Co.	In So. CA	In U.S.	Imports	Total
28	27%	20%	53%	1%	100%
29	13%	20%	64%	3%	100%
30	58%	13%	30%	0%	100%
33	35%	10%	55%	0%	100%
34	57%	27%	16%	1%	100%
349	82%	15%	3%	0%	100%
35	72%	17%	11%	1%	100%
359	84%	10%	6%	0%	100%
36	49%	20%	28%	3%	100%
367	44%	18%	35%	3%	100%
37	50%	16%	30%	4%	100%
3724	59%	8%	32%	1%	100%
3728	51%	20%	27%	2%	100%
376	44%	17%	37%	1%	98%
38	53%	21%	24%	1%	100%
3812	46%	23%	29%	2%	100%
382	59%	20%	21%	0%	100%
50	25%	10%	65%	0%	100%
73	30%	4%	6%	0%	40%
87	57%	6%	20%	0%	83%
8731	54%	5%	21%	0%	80%
Overall	49%	17%	28%	2%	96%

TABLE 6

SURVEY DATA ON RELOCATION

Relocate:	Firm Distribution
No	76%
Yes	24%

Relocate:	% of Total Employment
No	39%
Yes	61%

Firm Size (No. of Emp.)	Relocate: NO	Relocate: YES
<=100	58%	40%
101–500	23%	32%
501–1000	14%	0%
>1000	5%	28%
Total	100%	100%

Firm Size (No. of Emp.)	Relocate: NO	Relocate: YES	Total
<=100	82%	18%	100%
101–500	69%	31%	100%
501–1000	100%	0%	100%
>1000	36%	64%	100%

		Distribution
STAY		
	Grow	33%
	Stable	31%
	Decrease	12%
RELOCATE		
	Grow	7%
	Stable	9%

Business Environment Factors	RATING Overall	Relocating NO	Relocating YES
SUPP AVAIL	1.74	1.76	1.60
SUPP PRICE	2.82	2.84	2.76
SUPP QUALIT	2.26	2.25	2.28
OVERALL		2.29	2.21

Business Environment Factors	RATING Overall	Relocating NO	Relocating YES
MGRS	1.88	1.85	1.96
ENGINEERS	1.72	1.68	1.83
ADMIN	2.13	2.08	2.26
SKILLED	2.20	2.19	2.26
UNSKILLED	2.22	2.20	2.32
WAGES	3.65	3.58	3.80
BENEFITS	3.66	3.52	4.04
WORKER COMP	4.21	4.09	4.52
HOUSING	4.52	4.49	4.68
WEATHER	1.51	1.49	1.60
NAT RESOURCE	2.38	2.34	2.56
EDUCATION	2.34	2.24	2.72
CULTURAL	2.08	2.03	2.28
COMMUTE	4.25	4.16	4.56
REAL ESTATE	4.30	4.21	4.60
WATER	3.34	3.23	3.68
ELECTRICITY	3.26	3.18	3.52
GAS	3.13	3.03	3.44
INS COVERAGE	3.15	3.13	3.20
INS COST	4.10	4.00	4.36
OVERALL		2.94	3.21

Business Environment Factors	RATING Overall	Relocating NO	Relocating YES
A.Q. COST	4.32	4.25	4.56
A.Q. TECH	4.04	4.00	4.16
AQ BUREAUCR	4.38	4.28	4.64
W.Q. COST	3.73	3.68	3.92
W.Q. TECH	3.64	3.61	3.72
WQ BUREAUCR	3.89	3.82	4.08
ANTICIP REGS	4.32	4.20	4.64
OVERALL		3.98	4.25

Business Environment Factors	RATING Overall	Relocating NO	Relocating YES
PROPERTY TAX	3.73	3.75	3.68
PAYROLL TAX	3.60	3.59	3.64
INCOME TAX	3.84	3.72	4.24
LICENSES	3.82	3.75	4.08
OVERALL		3.70	3.91

Business Environment Factors	RATING Overall	Relocating NO	Relocating YES
CITY	3.68	3.55	4.08
COUNTY	3.76	3.62	4.17
STATE	3.78	3.70	4.00
FEDERAL	3.52	3.42	3.79
OVERALL		3.57	4.01

Please return completed questionnaire to:

ECONOMIC ROUNDTABLE
315 W. Ninth St., Suite 310
Los Angeles, CA 90015
ATTENTION: ATF Survey

Tel. 213/892-8104

This study is being conducted under an Economic Development Administration grant awarded to the County of Los Angeles in coordination with the Aerospace Task Force.

Label

ALL RESPONSES ARE KEPT CONFIDENTIAL
Whom should we contact with any further questions?

Name: ____________________
Position: ____________________
Phone: ( ) ____________________

PART I: BUSINESS OPERATIONS

1. How long has the establishment been at this address? ____________ years

2. Total employment at this particular establishment? ____________ employees

3. Do you do manufacturing at this establishment? Yes ☐ No ☐

4. What are the main products/services of this establishment?
   A. ____________________
   B. ____________________
   C. ____________________

5. What percentage of your total sales is manufactured for the Dept. of Defense? ____________ %

6. Total annual $ sales volume of this establishment? $ ____________

7. What percentage of your total annual sales consists of:
   A. Off-the-shelf (i.e. catalog or proprietary) items? ____________ %
   B. Work subcontracted to you from other firms? ____________ %
   C. Custom products? ____________ %
   D. Other (please specify) ____________ ____________ %

8. Approximately how many different customers (both large and small) has your establishment dealt with over the past year?
____________ customers

9. Who were your top five customers over the last year?

Customer's name & city	Total annual purchase	Main items sold
1.		
2.		
3.		
4.		
5.		

10. What percentage of all your customers over the last year are located within
   A. Los Angeles County? _______________ %
   B. the rest of Southern California? _______________ %
   C. the rest of the United States? _______________ %
   D. the rest of the world? (i.e. exports) _______________ %

11. Who were the five main suppliers/subcontractors of materials and equipment to your establishment over the last year?

Supplier/subcontractor name & city	Total annual purchase	Main items sold
1.		
2.		
3.		
4.		
5.		

12. What percentage of all of your purchases (both supplies and work that you subcontracted out) over the last three years originated from establishments within:

   A. Los Angeles County? _______________ %
   B. the rest of Southern California? _______________ %
   C. the rest of the United States? _______________ %
   D. the rest of the world? (i.e. imports) _______________ %

13. What do you expect to be your top five Department of Defense programs in the next five years, 1992 to 1996, if any?

PROGRAM	CONTRACT VALUE $
1.	
2.	
3.	
4.	
5.	

14. Have you relocated any parts of your facility in the past five years, 1987-1991? Yes ☐ No ☐

a. If yes,

Date	Operation	# of Jobs	Relocation site (city & state)

Please continue on back of sheet if necessary.

15. Do you anticipate any relocation activity from this establishment in the next five years, 1992-1996? Yes ☐ No ☐
If yes, where?__________________________________.

16. If you cut production, do you move a larger ☐ or smaller ☐ share of your work in-house? No change ☐.

17. If you cut production, do you buy a larger ☐ or smaller ☐ share locally than before? No change ☐

PART II: BUSINESS CONDITIONS IN LOS ANGELES COUNTY

Please categorize the following factors of the Los Angeles business environment accordingly:
1 - **Major strength** of the Los Angeles County business environment
2 - **Competitive** with other business environments
3 - **Neutral**
4 - **A disadvantage** in doing business in Los Angeles County
5 - **A deterrent** to doing business in Los Angeles County

Circle one

	Positive		↔		Negative
Use of Local Suppliers/Subcontractors					
18. Availability	1	2	3	4	5
19. Price	1	2	3	4	5
20. Quality	1	2	3	4	5
Factors of Production					
21. Labor					
A. Skill levels of locally available					
a. Managers	1	2	3	4	5
b. Engineers & scientists	1	2	3	4	5
c. Administrative & clerical	1	2	3	4	5
d. Skilled workers	1	2	3	4	5
e. Unskilled workers	1	2	3	4	5
B. Costs					
a. Salaries & wages	1	2	3	4	5
b. Fringe benefits	1	2	3	4	5
c. Workman's compensation	1	2	3	4	5
C. Inducements/deterrents to recruitment					
a. Housing prices	1	2	3	4	5
b. Weather	1	2	3	4	5
c. Natural resources	1	2	3	4	5
d. Educational facilities	1	2	3	4	5
e. Cultural opportunities	1	2	3	4	5
f. Commute to job	1	2	3	4	5

22. Facilities					
A. Real estate costs	1	2	3	4	5
B. Utilities					
a. Water	1	2	3	4	5
b. Electricity	1	2	3	4	5
c. Gas	1	2	3	4	5
23. Insurance					
A. Coverage available	1	2	3	4	5
B. Cost	1	2	3	4	5
Environmental regulations					
24. Air quality regulations					
A. Cost of Compliance	1	2	3	4	5
B. Difficulty of Compliance					
a. Technical	1	2	3	4	5
b. Bureaucratic	1	2	3	4	5
25. Water quality regulations					
A. Cost of Compliance	1	2	3	4	5
B. Difficulty of Compliance					
a. Technical	1	2	3	4	5
b. Bureaucratic	1	2	3	4	5
26. Anticipated environmental regulations	1	2	3	4	5
State & Local Taxes					
27. Property	1	2	3	4	5
28. Payroll	1	2	3	4	5
29. Income	1	2	3	4	5
30. Licenses	1	2	3	4	5
Public Sector Support					
31. City	1	2	3	4	5
32. County	1	2	3	4	5
33. State	1	2	3	4	5
34. Federal	1	2	3	4	5
Other					
35. ______________________	1	2	3	4	5
36. ______________________	1	2	3	4	5

PART III: BUSINESS OPPORTUNITIES

37. Please list the three most promising new products for your firm in the next five years.

A.____

B.____

C.____

38. Please rate the following as strategies your firm uses to remain competitive in aerospace and high technology.
V=Very Important I=Important N=Not Important

__ Just-In-Time Delivery
__ Inventory Management
__ Quality Improvement Programs
__ New Product Development
__ New Markets for Existing Products
__ Upgrading Plant & Equipment
__ Downsizing Workforce
__ Increasing R&D Expenditures
__ Decreasing R&D Expenditures
__ Relocation to Another Region
__ Market Forecasting
__ Product Improvement
__ Information Technology
__ Expediting Product Development
__ Acquitisions/Mergers with Other Firms
__ Other ______________________

39. How do you upgrade the technology in your manufacturing or services? Please check all items that apply.

☐ In-House Research and Development Staff
☐ University Research Program
☐ Independent Consultants
☐ Other Firms
☐ Trade Associations/Publications
☐ This is a problem area for us and we are interested in more information
☐ Other ______________________

40. Over the next five years do you expect your establishment's employment to:

Grow ☐ Remain Stable ☐ Decline ☐

41. Are you interested in finding out more about assistance that local government can provide in:
Developing affordable housing for your workers ☐
Identifying new sites that would better meet your manufacturing needs ☐
Expediting regulatory procedures ☐
Training your workers ☐
Other ______________________ ☐

42. Comments

____
____
____
____
____
____
____
____

♦◊♦◊♦◊♦◊

THANK YOU FOR YOUR COOPERATION
If you would enclose a copy of your annual report it would be greatly appreciated

♦◊♦◊♦◊♦◊

Chapter 2

DEFENSE CONTRACTING AND THE LOS ANGELES COUNTY ECONOMY

by Michael N. Beltramo

SUMMARY OF FINDINGS

- **A majority of the County's high technology industrial base is dependent on very large defense programs being carried out under contracts awarded to a handful of large firms located in the County. It will take a long time for new industries based on emerging technologies to grow large enough to fill the void that would be created by the loss of one of these large defense programs. Therefore, the County has an important economic interest in remaining competitive in the defense marketplace.**

- **Defense revenues are concentrated in a small number of firms and programs. Ten firms account for 80 percent of the funds. This concentration makes the County vulnerable to relocation and/or loss of major programs.**

- **It is possible that defense funding for Los Angeles County in 1993 may be less than a third of what it was in 1987.**

- **Defense funds have been concentrated in the aircraft industry, but future prospects of this industry in Los Angeles County are bleak. The C-17 and the B-2 may be the last planes built in Los Angeles.**

- **Most of Los Angeles County's defense business is now for Research Development Test and Evaluation. Without a production base this also will decline.**

- **Los Angeles Air Force Space Division is a crucial facility for many of the County's most advanced space and electronics research and manufacturing programs; its possible relocation would be very damaging to the County's economy.**

- **The County's future strengths are in:**

    - **space and communications**

    - **subcontracting and components for new aircraft**

    - **spare parts and modifications for existing aircraft**

INTRODUCTION

Defense is a major component of the United States economy. It accounts for about seven percent of the gross national product with annual spending of more than $300 billion. Auto sales are about $200 billion annually. Defense and entertainment are said to be cornerstones of the Los Angeles County economy. Defense businesses brought more than $8 billion into the County during 1990. As a point of reference, recorded music has worldwide sales of about $7 billion.

Spending by the Department of Defense (DoD) is now in the third year of a sharp decline.[1] The decline will continue until its budget reaches a much lower steady state--barring a national emergency. Therefore, policy makers must grasp the impacts this will have for unemployment among specific job categories and industry sectors, as well as the geographic areas and political institutions that will be affected.

This analysis seeks to advance understanding of the importance of defense business to the Los Angeles County economy. Therefore, it examines specific characteristics of the Los Angeles County defense industry.

Many prior studies about Los Angeles County defense business have not reflected the nature of the changes that have taken place here over time. Rather, they have extrapolated aggregate national or statewide data as the basis for their forecasts. This imparts a severe "all else being equal" bias by failing to effectively consider or weigh the probabilities of specific events.[2]

This methodology is particularly inappropriate for Los Angeles County because of the importance of key contractors and large programs. They are both a major strength and a point of vulnerability. In Fiscal Year 1990 (FY 90), 1,284 Los Angeles County firms received 4,184 DoD contracts worth $8.881 billion. But a few large firms and major contracts tend to dominate the picture. Specifically, the ten largest firms received 80 percent of that amount while the 1,000 smallest collected less than 1 percent. The ten largest contracts accounted for 40 percent of the total, the 50 largest for 65 percent, and the 100 largest for 76 percent. The smallest 3,000 contracts amounted to less than 2 percent. Pivotal events such as winning or losing major programs and the relocation of a large firm out of the County have tremendous impacts.

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[1] Although the defense budget is officially now in its seventh year of decline, segments of the budget (e.g., non pay elements of Research Development Test and Evaluation, Systems Acquisition, Military Construction, and Operations and Support) that fund commercial enterprises are only in the third year of decline.

[2] For example, the extrapolation of national trends ignores the fact that contract awards have shifted away from Los Angeles County. Making local inferences based upon California data disregards the North/South emphases on commercial and military high technology, respectively, and also misses the movement of firms previously located in Los Angeles County to neighboring Southern California counties.

Objective

The purpose for this analysis of defense contracting is to develop a sound business forecast for the Los Angeles County defense industry that will support informed public policy decisions. To accomplish this:

- Key technologies and the programs and firms involved with them are identified to enable business retention initiatives to target areas of growth rather than contraction.

- Geographic areas that will be most severely affected are identified so government agencies and institutions can prepare more effectively for potential revenue losses and unemployment.

Beltramo and Associates assembled a data base that identifies funding sources and recipients of DoD business in Los Angeles County between 1987 and 1990 to perform the required analyses.[3] The methodology and data sources employed are described below.

Methodology

To accomplish the study's objective it was essential to obtain very detailed information about defense business within Los Angeles County during the past few years. A data base of defense contracts awarded to Los Angeles County firms was provided by the Office of Economic Adjustment (OEA) under the Office of the Secretary of Defense. It includes all Los Angeles County defense contracts greater than $25,000 during Fiscal Years 1987-90. It provides the following information for each contract:

- Weapon system code and description
- Issuing service or agency
- Contractor
- City
- Federal supply or service code and description
- Contract amount

Beltramo and Associates reconciled these data to eliminate internal inconsistencies and combined them into a large relational data base so other meaningful aggregations could be made. For example, the city and community data were coded so that defense funds could be allocated to statistical areas within the County.

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[3]The initial year covered by the data, 1987, has been cited by some as the high water mark for County aerospace employment. While that may be accurate, it obscures Los Angeles County's loss of DoD market share which began in the early 1980's. Data are not available in the same form shown in Figure 1 before 1987. However, roughly comparable data from 1983 through 1987 indicate that the Pacific Region's share of DoD Research Development Test and Evaluation (RDT&E) funds declined from about 46 percent to 38 percent and its share of funds for Procurement of major defense products declined from about 32 percent to 23 percent. Los Angeles County dominates the Pacific Region.

Other data were also obtained to yield meaningful benchmarks of Los Angeles County's performance compared with the rest of the country and to identify areas of particular strength. For example, OEA provided national summary data for federal supply, product, and service codes for Fiscal Years 1989 and 1990. This permitted the calculation of location quotients.[4]

Assumptions and projections about the County's future defense business were made using a more heuristic approach. Specifically, Beltramo and Associates acquired and analyzed the President's defense budget submission, Congressional mark-ups, political speeches, and applicable news that would have a probable effect on the direction and content of future defense budgets. Findings and conclusions are discussed following a description of the limitations of the data base and, more importantly, the nature of the defense business it portrays.

Limitations of the Study

There are some important and unresolvable limitations inherent in available data. They include:

- Contract data are provided only for prime contractors.
- Much of a contract may be performed in a place different from that where it was awarded.[5]
- Neither special access classified programs nor their expenditures are indicated.
- The relationship of many programs to a particular weapon system is not shown.
- Only commercial funding is identified in the data base.

This prevents a precise and detailed representation of the size and substance of defense programs in the County. However, even with these limitations, the data support meaningful and important findings. The nature and implications of data limitations are discussed below.

Prime Contractors, Subcontractors, and Location of Award

A long held rule of thumb is that 66 to 75 percent of DoD prime contract funds are spent by firms other than the prime contractor (i.e., subcontractors and vendors). This implies that most prime contract funds awarded here would be spent by firms other than the initial recipients. Furthermore, they might migrate to another area. Although this rule of thumb may be reasonably accurate, it is also misleading because it applies primarily to large production contracts. Most of Los Angeles County's defense business is for Research Development Test and Evaluation and Services (RDT&E) where the flow of funds from a prime contractor to its subcontractors is not nearly as substantial.

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[4]A location quotient measures the relative strength of an industry in a particular locality compared to the nation as a whole.

[5]Data related to this issue has been collected, analyzed, and reported by the Economic Roundtable study which was funded under the OEA grant.

Furthermore, money does not flow in only one direction. Although Los Angeles County primes may subcontract with firms in other geographic areas, Los Angeles County subs may also receive business from firms in other areas. The extent to which the inflow compensates for the outgoing funds is unknown.

In addition, there is a common misunderstanding about the meaning of "prime contractor" and "subcontractor." The prime contractor on a large production program is frequently the system integrator (i.e., the firm that performs final assembly, inspection, test, and delivery). Thus, prime contractor and systems integrator are often used as synonyms. A subcontractor is commonly thought of as a firm that provides major subsystems or components under an agreement with the prime contractor.

In reality, the distinction between prime and subcontractor is not nearly so precise. Rather, the Government Program Office determines how it will manage a program and award contracts. This establishes the number and roles of prime contractors that will be involved. An extreme example is the M1-A1 Tank program where the Program Office chose to act as "prime contractor." It awarded more than 300 prime contracts to firms in 35 states for FY 88. Of the $1.373 billion allocated that year, General Dynamics, the systems integrator, received only about $770 million. This contrasts dramatically with typical programs.

The difference between the location of contract award and contract performance is another related problem. Available data show location of contract award. But a large portion of contract funds awarded to a firm in one city may be spent by a subsidiary in another.

Special Access Classified Programs

The data base problems discussed above would probably tend to overstate the value of defense funds actually expended in Los Angeles County. However, this would be more than offset by the existence of very large "black" or classified programs requiring special access security clearances. The government does not publish budgetary information related to such programs or even acknowledge their existence. In many cases these are identified only when they enter production, in some cases when their product is deployed by entering service, and in others they may only receive recognition long after they have been retired, if at all.

This presents a particularly vexing problem for Los Angeles County because of our long history of being on the cutting edge of large, high technology ventures. For example, Lockheed's Skunk Works developed and produced all of this country's "spy planes" (e.g., U-2, TR-1, and SR-71) "in the dark." It also completed production of the F-117A Stealth Fighter which was in service for some time before it was officially recognized. Similarly, Northrop developed the B-2 bomber before its existence was officially conceded. Northrop is also developing the Tri-Service Standoff Attack Missile (TSSAM) and was prime contractor for Tacit Rainbow missile before it was terminated. They are or were classified and not shown in any program contract awards listing.

The size of individual classified programs is potentially huge. Original plans called for 132 B-2 aircraft. More recent plans called for 75 B-2's at a total cost of about $65 billion. Even if only the 15 B-2's currently ordered are produced, budgets of about $2 billion per year should continue until production ends. Production of 8,650 TSSAMs is planned at a total cost of $15.1 billion. The existence of such a large unidentified program could make an important difference in the prognosis for the Los Angeles County economy.

Since many RDT&E and Services contracts are not related to specific weapon systems, more than 60 percent of all DoD contracts awarded in Los Angeles County are coded as "Not Discernable or Classified." This makes it difficult, if not impossible, to identify and track the funds associated with major programs that are making a transition from research and development to production. For example, Northrop's aforementioned B-2 and the C-17 cargo aircraft being built by McDonnell Douglas are some large programs that are not specifically identified in the data base before 1990. Lockheed's F-117A and P-7A are not found at all.

Spending for Government Installations

Since the data base is limited to commercial funding, the importance of government installations and their associated employment is not reflected. Therefore, large expenditures for payroll and operations at government installations is overlooked. For example, the Space Systems Division (SSD) is part of the Air Force Systems Command. It is headquartered at Los Angeles Air Force Base in El Segundo. Los Angeles AFB employs 2,799 government personnel (1,171 Air Force Officers, 407 enlisted personnel, 1,221 federal civilians). In addition, 521 base support contractor personnel are employed directly at the Base.

However, its importance is far greater than its direct contribution to the Los Angeles County economy. The Space Systems Division is one of three Air Force product divisions.[6] SSD is responsible for buying all Air Force satellites and rocket boosters to launch satellites. Its budget was $7.6 billion in 1990 and increased to $7.8 billion in 1991. Therefore, it is not a coincidence that the South Bay statistical area which surrounds it is the largest recipient of DoD funds in the County. It received more than $9.9 billion from 1987-1990. A substantial portion of those funds is undoubtedly related to the desire of firms to locate near their key customers.

Findings

The limitations identified above indicate that available data cannot answer all questions that might be of interest with perfect reliability. But the data provide a fascinating picture of the defense component of the Los Angeles County economy. This picture is presented below beginning with a very broad description of: the amount of money flowing into the County, the

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[6]The other two are the Aeronautical Systems Division at Wright-Patterson AFB, OH and the Electronic Systems Division at Hanscom AFB, MA.

areas and companies reaping the benefits, the purposes for which it is being used, and the agencies providing the funding. Figure 1 provides an initial frame of reference by showing total DoD budget authority for categories covered in the Los Angeles County data. As indicated, the DoD budget remained fairly constant (in then year--TY--dollars) during the relevant time frame.[7]

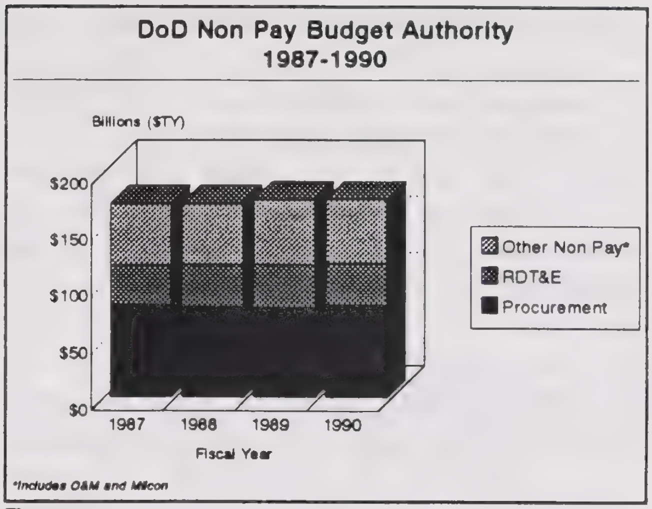

Figure 1

Los Angeles County leads all other counties by a wide margin as a recipient of DoD funds. Leading counties are shown in Figure 2. Although Los Angeles County still maintains a commanding lead over the rest of the nation, the number of DoD contracts, number of firms receiving a contract, and total value of DoD funding decreased steadily here between 1987-1990. Specifically, between 1987 and 1990 DoD funding received by Los Angeles County firms declined by about 11 percent.[8] About 18 percent fewer firms received DoD funding and the number of contracts awarded declined by about 22 percent. This is shown in Figure 3. If there is a bright side to these statistics, it is that average contract value increased by about 14 percent.

Communities and Firms Receiving DoD Funding

Only six cities in the County received no DoD funds during the period covered. But ten cities received nearly 90 percent of the funds.[9] They are shown graphically in Figure 4.

Because the City of Los Angeles is so widely dispersed, DoD funding was also distributed by Statistical Area to show how its share was apportioned within the County.[10] Ten (of 35) statistical areas accounted for about 85 percent of DoD funding in Los Angeles County. They are shown graphically in Figure 5. As indicated, the preponderance of defense business is located along the coast from the South Bay through Long Beach with the Valley also receiving a large share. Thus, DoD funds are widely scattered among the County's component cities but

[7] Those DoD budget categories declined by about five percent in real dollars.

[8] The decline is about 20 percent in real dollars.

[9] Unincorporated areas of the County received less than one percent.

[10] This could not be done precisely because of data limitations related to firms in the City of Los Angeles; however, about 90 percent of funds in the City were allocated to the appropriate statistical area.

relatively concentrated by geographic area. Tables 1 (DoD Contract Awards in LA County Cities and Communities 1987-1990) and 2 (DoD Contract Awards to LA County Statistical Areas 1987-1990) indicate how DoD funding is distributed by City and Community, and by Statistical Area, respectively.

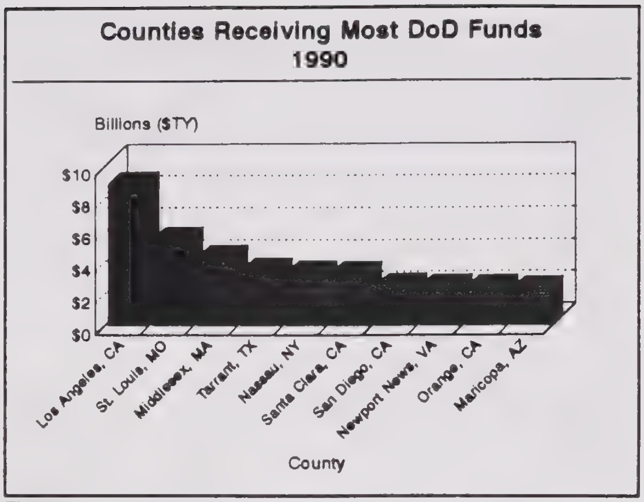

Figure 2

Department of Defense funds coming into the County are concentrated among a few major firms. DoD funding for the ten contractors that received the most funds is shown graphically in Figure 6. Those contractors have received more than 75 percent of DoD funds coming into the County during the referenced period. Moreover, this percentage increased from 71 percent in 1987 to 80 percent in 1990. This concentration greatly increases the County's vulnerability to the relocation of its principal defense firms and/or losses of major programs.

Sources and Purposes of DoD Funds
The overview provided above indicates how DoD funding has been dispersed throughout Los Angeles County and its major defense contractors. It is also useful to identify the sources of those funds and the purposes for which they were provided.

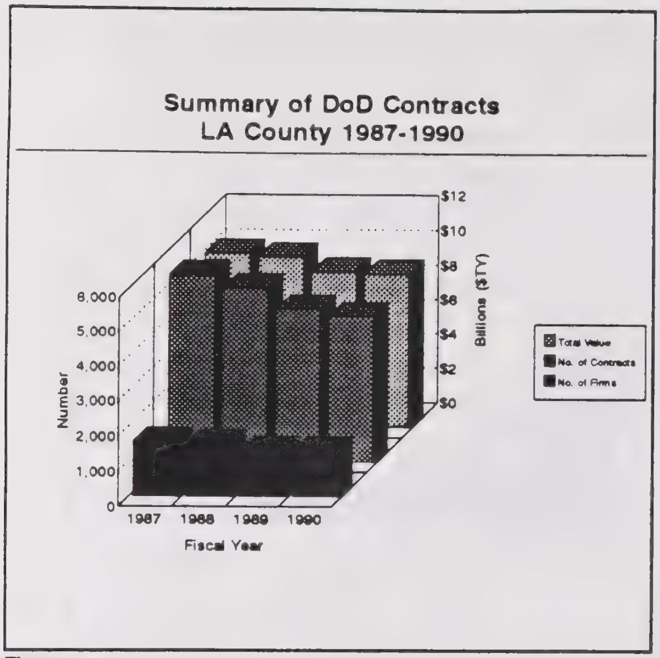

Figure 3

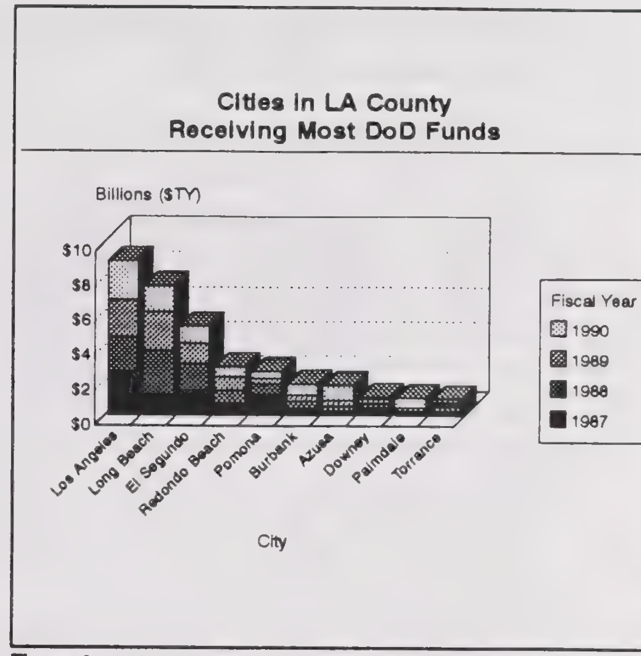

Figure 4

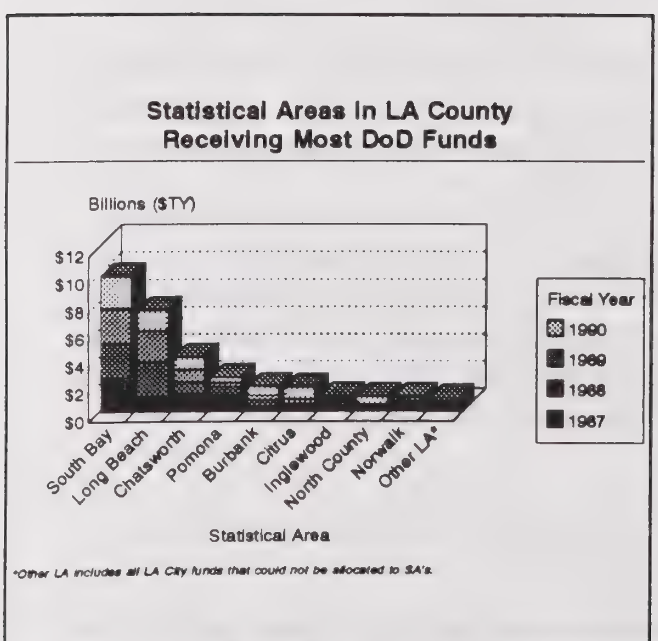

Figure 5

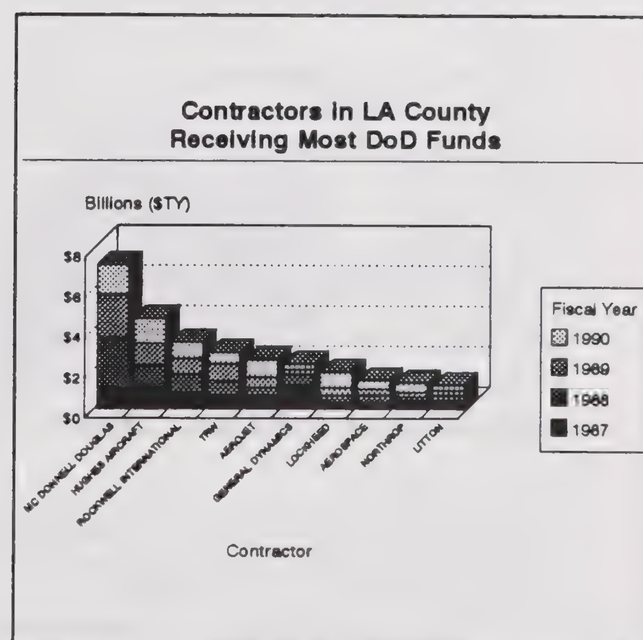

Figure 6

Air Force funding is increasing both relatively and absolutely while funding from other Services has declined. The contribution of each Service to Los Angeles County is shown in Figure 7.

A shift is taking place in Los Angeles County in the kinds of DoD business we are obtaining. It is both interesting and alarming. Specifically, DoD expenditures for Products in Los Angeles County have declined from nearly $6 billion in 1987 to about $3.3 billion in 1990, or from about 60 percent of its total expenditures to less than 40 percent. During that period, Research Development Test and Evaluation funds have fluctuated while funds for Services have remained stable until 1990.[11] This shift is illustrated in Figure 8.

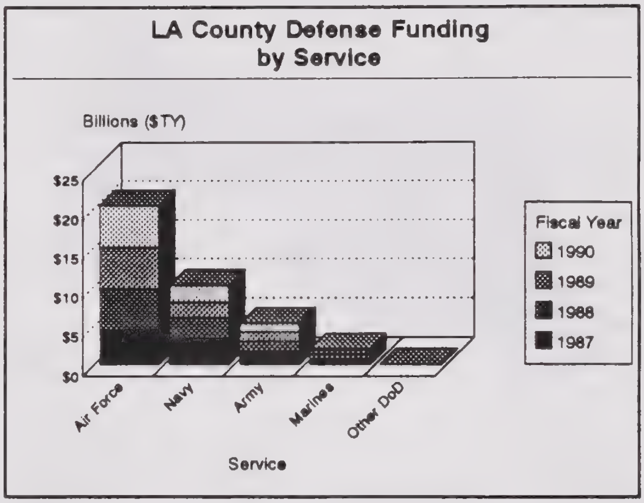

Figure 7

Comparable national data were obtained for 1989 and 1990 to determine the relative strengths and vulnerabilities of Los Angeles County in key areas. This was done by location quotients and their more detailed cousins, "specialization ratios." A specialization ratio of greater than unity would indicate an area of competitive advantage. However, for areas where the budget was declining it could be viewed as a "vulnerability ratio." These data are shown in Table 3 (Summary of Top DoD Products and Services for LA County and National).

A word of caution is appropriate before considering defense categories of principal importance to Los Angeles County. The vagaries of contract funding time frames and the multi-year character of some contracts may indicate a sharp growth or decline that is more apparent than real.

Research and Development for Defense Systems, and Space and Professional, Technical and Management Services have been areas of strength for non product contracts. Since nearly 30 percent of the County's defense prime contracts has been for Defense System RDT&E during the period covered, it merits particular attention. Its overall location quotient is slightly better than unity; however, that conceals many strengths, weaknesses, and areas of concern.

[11]Actually, funding for Services increased dramatically in 1990 because of a single program, Aerojet's sensor payload which is provided to the Defense Support Project. This is a two decade old highly classified component of our nation's defense warning systems. It also involves TRW as a systems integrator and provider of DSP satellites.

RDT&E for aircraft dominates RDT&E funding for Defense Systems within Los Angeles County. Missiles and space systems funding is a very distant second. Since Aircraft and Airframe Structures and Aircraft Components and Accessories lead Product funding, particular attention is paid to that industry sector. A breakdown of all RDT&E funds received in Los Angeles County between 1987 and 1990 is presented in Table 4 (DoD Contract Awards to LA County for RDT&E 1987-1990).

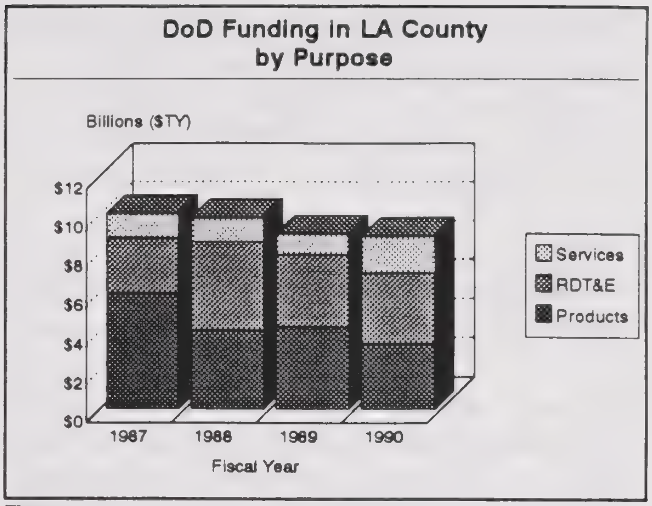

Figure 8

The production of major weapon systems is preceded by a series of milestones. New programs typically begin by determining the feasibility of a concept and, perhaps, testing initial prototypes. Following these stages, a program enters full scale Engineering Development and Operational Systems Development where the bulk of RDT&E funds are spent to prepare a new system for production. Thus, there is a strong connection between full scale development and production. Performing research merely to demonstrate and validate a new concept that will not be produced immediately is a relatively small effort.

A healthy defense industry is characterized by a pipeline into which basic, exploratory, and advanced research move steadily toward engineering development, culminating with production. Mature programs are, thereby, replaced by new ones and continuity is retained. The key point is: without a viable production capability, the high value component of RDT&E is lost. Production and preliminary development grew in 1990 while engineering development contracted as indicated in Figure 9. This observation is interpreted in the following section on future prospects.

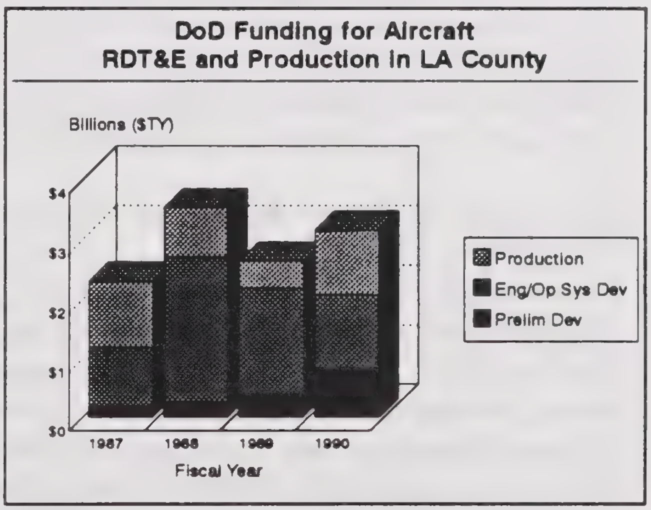

Figure 9

Aircraft Components and Accessories has been a product area where the County has retained its strength.[12] It accounted for $1.7 billion in Product sales during the 1987-1990 period. That

[12]This category consists largely of subsystem components such as air conditioning, hydraulics and flight controls, and landing gear.

amount is somewhat skewed by nearly $500 million received by Rockwell during 1987 and 1988 for the B-1. Even when those amounts are omitted, the category shows a steady increase and should continue to increase as McDonnell Douglas' C-17 enters full rate production. Furthermore, since much of this work is for the logistics pipeline it should remain stable or increase as existing aircraft stay in service longer.

Aircraft and Airframe Structures is a key Product category where the County has slipped. The location quotient for this category is below the unity level for the two years reported.[13] And prospects for the future are discouraging as discussed in the following section.

Research and Development funds related to space are expended for the Strategic Defense Initiative (SDI) and Space Vehicles. SDI is spread among several categories including: missiles and space systems, weapons, and other defense. It has contributed at least $200 million per year to the County economy between 1988 and 1990 based upon readily identifiable contracts. However, the term "at least" is particularly important because of the highly classified nature of much SDI work.

Space Vehicles has been an area of consistent strength for the County, but it is not a dominant component of the DoD budget. Funding for County firms for Space Vehicles has also been about $200 million annually for 1988 and 1990. In 1989, TRW increased the total with an Air Force contract for more than $360 million. Funding for Space Vehicles should remain strong although funding for other Space programs should be greater.

Guided Missiles began to rebound at the end of the period after a precipitous fall from 1987's total sales of nearly $1 billion. However, the big story here is not in the contract data as much as changes that are affecting this markets. They are discussed in the following section.

Discussion and Future Prospects

If Los Angeles County's defense industry lagged during the late 1980's, its prospects for the future are dismal. Figure 10 displays Los Angeles County defense contract revenue from 1987-1990, and DoD Non Pay Actual and Proposed Budget Authority from 1987-1993. Using these data as independent variables, a trend was calculated. The trend forecasts Los Angeles County Defense contract revenue based upon its past relationship with the DoD budget. As indicated, 1993 revenue could fall to just 29 percent of 1987 revenue or about $3.5 billion ($FY92).

This calculation improves slightly on many previous extrapolations of macro data by considering Los Angeles County activity specifically. However, a more useful projection requires

[13]A major issue here is the potential existence of classified programs which may make available data incomplete and misleading.

consideration of Los Angeles County's relative strengths and weaknesses. Here, three issues are important:

- The current funded base,
- Future funding prospects for existing and planned programs, and
- The County's capabilities in those areas.

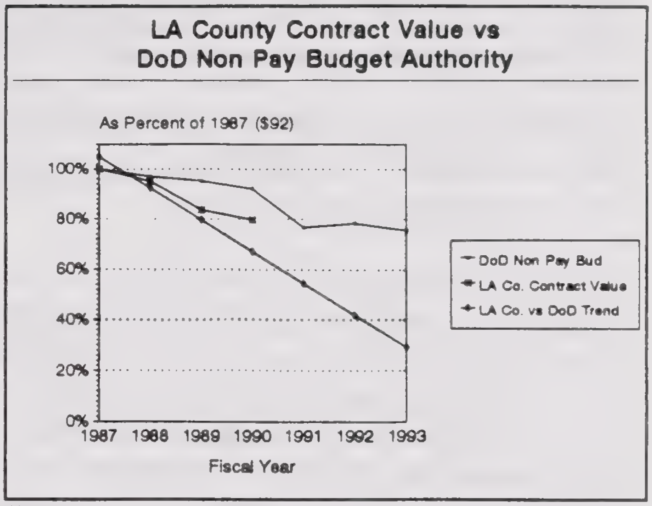

Figure 10

The proposed Department of Defense Budget for 1991-1993 provides a useful frame of reference evaluating future prospects. As indicated in Figure 10, the real decline of nearly 17 percent for Total DoD Non Pay funds between 1990 and 1991 is crucial to this analysis.[14] Since Los Angeles County defense contractors fared so poorly during the relatively stable DoD budget period of 1987-1990, the question of what happened last year is particularly important.[15]

Moreover, since political fragmentation of the Soviet Union occurred after the President's budget proposal was made public there is reason to assume the 1993 and 1994 budgets may be much lower than the plans indicate. However, a potential bright spot is that proposed DoD funding for RDT&E is expected to decline the least. It is now Los Angeles County's greatest strength.

The defense industry component of the Los Angeles County economy suffers from three different sets of problems:

- External realities (i.e., the decline of the DoD budget and short-sighted government systems acquisition policies),
- Internal barriers (i.e., disincentives for doing business here),
- Mismanagement at the firm level (e.g., the loss of major programs because of insoluble technical problems, cost overruns, and schedule slippages).

Similarly, the County has three general options for managing past and potential future losses: retain existing defense firms, attract new defense business, attract other high technology business.

[14]This includes all funds for Operation and Maintenance (e.g., replenishment spares), Procurement (e.g., major weapon systems), Research Development Test and Evaluation, and Construction except for military and civil service pay and benefits.

[15]In fact, the 1991 decrease DoD Non Pay Budget drives down the trend line shown in the Figure. If Los Angeles County performed better than expected, the forecast would improve.

The solution is, of course, a combination of the three. But accomplishing each may require a different strategy.

A survey of the business potential of existing and planned programs in Los Angeles County is not encouraging. Assessments of some of the County's largest programs in 1990 and its key industry segments follow.

Los Angeles County Aircraft Programs
A few large programs constituted nearly 40 percent of the funding received by Los Angeles County in 1990. The outlook for all of them has deteriorated since 1990. Since nine of the eleven programs shown are in aircraft production (including the airframe itself or subsystems and major components), the status of that industry is discussed first. Figure 11 summarizes these programs, including firms and cities involved and work performed. Detail for these programs is provided in Table 5 (Largest Defense Programs in LA County - 1990).

Aircraft RDT&E and Production accounted for about a third of the County's DoD funding between 1987 and 1990.[16] Its outlook is particularly bleak. Thirteen aircraft were either being developed or produced in Los Angeles County by five prime contractors during the 1980's as shown in the following Table.

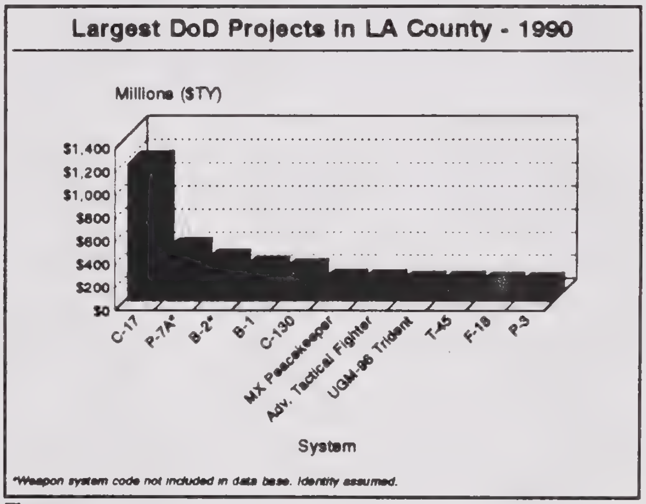

Figure 11

[16] This amount is substantially understated because the Advanced Tactical Fighter Program required contractor cost sharing of approximately one billion dollars per team in addition to the amounts shown in the DoD contract data. Since both teams were led by Los Angeles County firms, much of that amount was spent here.

MILITARY AIRCRAFT PROGRAMS IN LA COUNTY SINCE 1981				
MODEL	TYPE	SERVICE	CONTRACTOR	STATUS
AH-64	Helicopter	Army	Hughes (now McDD Helicopter)	Production Moved to Mesa, AZ.
AV-8B	Attack	Navy	McDD	Production Moved to St. Louis. Now complete.
B-1B	Bomber	AF	Rockwell International	Production completed.
B-2	Bomber	AF	Northrop	Approval to produce 15 aircraft. Additional production unlikely.
C-17A	Cargo	AF	McDD	Experiencing cost overruns. Substantial production moved to St. Louis.
F-5E,F	Fighter	AF	Northrop	Production completed.
F-20	Fighter	AF	Northrop	Lost final competition to F-16.
F-22	Fighter	AF	Lockheed/GD/Boeing	Won ATF competition. Production moved to Georgia.
F-23	Fighter	AF	Northrop/McDD	Lost ATF Competition to Lockheed/GD/Boeing.
F-117A	Fighter	AF	Lockheed	Production completed.
P-3C	Patrol (ASW)	Navy	Lockheed	Production completed. Update IV retrofits beginning FY 93.
P-7A	Patrol (ASW)	Navy	Lockheed	124 unit follow-on to P-3C. Production planned FY 94. Canceled July 1990.
T-45A	Trainer	Navy	BAe/McDD	Production moved to St. Louis and delayed. Requirement of 300 units.

Of these programs:

- Five (AH-64, AV-8B, C-17A, F-22, and T-45A) were moved entirely or in part primarily to avoid the perceived disincentives of manufacturing here.
- Four (B-1B, F-5E,F, F-117A, and P-3C) completed production.
- Two (F-20 and F-23) lost competitive source selections that kept them from entering production.
- One (P-7A) was terminated for default because its management could not meet cost and schedule requirements.

That leaves only two military aircraft production programs still active in the County. Chances are increasing that only the 15 B-2 bombers already ordered may be produced instead of the 75 recently planned. McDonnell Douglas has moved much of the C-17 production from Long Beach to St. Louis but the $500 million it has invested locally in tooling that is literally cast in concrete should keep its final assembly and program management here.

Therefore, the emigration of aircraft production from Los Angeles County which escalated during the 80's apparently will conclude with the completion of the C-17 Program. There is only one more major military aircraft program on the drawing board until well into the twenty first century: the Navy's A-X attack aircraft. There are several overlapping teams competing to develop and produce it but only the Lockheed/Rockwell pairing would place most of the work in Los Angeles County. Each competitor brings real assets and deficiencies into the competition, so the winner is difficult to anticipate. However, the local entrant is a long shot.

The situation is only exacerbated when commercial aircraft are considered. McDonnell Douglas, the County's last contender in that arena, has announced its next generation commercial aircraft (MD-12 Series) will be built someplace other than Long Beach. As shown in the previous section, the lack of a production capability impacts the richest component of RDT&E, engineering development. Therefore, Los Angeles County planners must focus on the "post aircraft" environment of the mid to late 90's and beyond to absorb this enormous economic loss and unemployment of the industry's highly trained scientific, engineering, and technical personnel.

Los Angeles County Missile Programs

The two top programs in 1990 that did not involve aircraft were related to the Peacekeeper and Trident ballistic missiles. As even the most casual observer of the changing international scene is well aware, nuclear arsenals have been sharply reduced so the demand for those weapons has declined greatly.

Although strategic missiles are out of favor, tactical missiles have long been an area of strength in Los Angeles County. A summary of missile programs in the County is provided in the following Table.

SUMMARY OF MISSILE PROGRAMS IN LA COUNTY SINCE 1981			
NAME/ DESIGNATION	LA FIRM	OTHER SOURCE	STATUS
AAAM	Hughes	Raytheon	In competition for Full Scale Development award.
AAAM	General Dynamics	Westinghouse	In competition for Full Scale Development award.
AMRAAM-120A	Hughes	Raytheon	Entering Production Phase.
FOG-M (N-LOS)	Hughes	Boeing	Canceled in Development.
Maverick-65D/G	Hughes	Raytheon	Final Order being Produced by Hughes.
Maverick-65E/F	Hughes	Raytheon	Final Order being Produced by Hughes.
Phoenix-54C	Hughes	Raytheon	Final Order being Produced by Hughes.
RAM-116A	General Dynamics	Ramsys	405 missiles authorized FY91 but no funding.
SLAM	Hughes	McDonnell Douglas	Concept Development.
SRAW	Hughes		NA
Sparrow-7M	General Dynamics	Raytheon	Moved to Rancho Cucamonga. Final Purchase FY89.
Standard ARM-78D	General Dynamics	Raytheon	Procurement quantities declining because of budget constraints.
Stinger-92A	General Dynamics	Raytheon	Final Navy buy FY88.
Tacit Rainbow	Northrop	Raytheon	Canceled in Development.
TOW2-71C/D	Hughes		NA

The pattern is eerily similar to that of aircraft. The primary difference is that missile production was not initially moved from the Country by choice. Instead, it was taken away by firms from other areas who dominated second source production competitions against Los Angeles County firms, namely Hughes Aircraft and General Dynamics.[17]

To become more competitive these firms relocated some or most of their production capability. Hughes now assembles its missiles in Tucson, Arizona and has established component manufacturing plants in low cost areas of the South East. General Dynamics initially established

[17]Such competitions came into vogue during the 80's defense build-up as DoD sought to achieve assumed economic benefits of competition by establishing alternative suppliers for key weapon systems.

a plant in Rancho Cucamonga which it has now closed as a result of the weak economy. It has since built a missile assembly plant on a Navajo reservation in Arizona and has reduced hourly labor costs by about 40 percent. Furthermore, recent competitive losses and statements from General Dynamics management have cast doubt on its continued presence in Pomona.[18]

The abundant bad news about the County's defense industry cannot and should not be trivialized. But a few areas of strength will remain. They include especially: subcontracting and major components for new aircraft, the production of spare parts for and modifications to existing aircraft, and space and communications.[19]

It is notable that four of the projects shown in Figure 11 did not include final assembly in Los Angeles County. They are the F-18 and C-130 in addition to the two aforementioned ballistic missile programs. These programs underscore the County's vitality in a variety of areas associated with advanced electronics. This will become particularly important as existing weapon "platforms" are modified and upgraded to enhance effectiveness at a cost far less than a new production project.

Moreover, the Space Defense Initiative was recently given a boost by Congress as its FY 92 Budget was approved at more than $4 billion. And, although the Program has changed greatly since President Reagan's initial vision, some of its components may enter production and be deployed soon. Since local firms (including TRW, Rockwell, Aerospace Corp., Aerojet, and Hughes Aircraft, among others) have played important roles in the program, they should reap important benefits.

Conclusions

Choices faced by Los Angeles County policy makers attempting to retain the local defense industry during the post cold war era are somewhat akin to locking the barn after the horse is gone. However, it may not be too late to determine why the horse left, so at least some of the herd can be retained. Additionally, the shrinking defense industrial base may be the result of problems related to other manufacturing enterprises. Thus, solving them may boost seemingly unrelated industry sectors.

Identification and discussion of specific problems and strengths associated with the local environment is addressed in other chapters of the Economic Adjustment Strategy. Findings from this analysis of the defense industrial base are noted below.

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[18]GD will produce only 20 percent of the 1991 production quantity of Standard Missile. Next year, they face a winner-take-all competition against Raytheon (the second source) to produce the remaining missiles the Navy will purchase.

[19]For example, a planned improvement program for the F-117A fleet should be worth several hundred million dollars during the next decade.

Retaining a Viable Defense Industry
Although defense spending has declined precipitously over the past few years and will continue downward, it will probably not dip below $200 billion annually in the foreseeable future with more than $50 billion going to the private sector. That is a very large amount of revenue by any standard, and a competitive defense industry will be able to capture a greater share of the market. Since the metamorphosis of large defense firms into commercially prosperous entities is not feasible in the near term, a key element of an economic adjustment strategy must be to bolster the prospects of local defense firms.

Research and Development efforts within Los Angeles County are particularly vulnerable. Although the overall location quotient is close to unity, it conceals many strengths, weaknesses, and areas of concern. In particular, the production capability for Los Angeles County's aircraft and missiles industries has severely eroded. Those industries have been the core of the County's defense industrial base. The absence of a viable production capability here means that the high value component of RDT&E (i.e., engineering and operational systems development) will also be lost. Thus, it is doubtful that research and development vitality will be retained in those industries.

It is difficult to overstate the importance of key contractors and large programs to Los Angeles County. Specifically, the ten largest firms received 80 percent of DoD contract awards to Los Angeles County in 1990 and the ten largest contracts accounted for 40 percent of that total. This concentration greatly increases the County's vulnerability to the relocation of its principal defense firms and/or losses of major programs. Therefore, a primary policy focus must be the retention of those large firms that still remain in Los Angeles County.

Retaining important firms is linked in part to keeping the Air Force Space Systems Division in El Segundo. Space and communications are keys to the County's continued role in aerospace. Currently, the Air Force is considering moving Space Systems Division to Kirkland AFB, New Mexico, largely due to a shortage of affordable housing for its military personnel in Los Angeles. Many large Los Angeles County defense firms are located near the SSD facility in El Segundo and would follow SSD if it relocates to Albuquerque, New Mexico. Space Systems Division's movement to New Mexico is a frightening possibility that would exacerbate the loss of aircraft and missiles business. Although the direct contribution of SSD cannot be estimated precisely, it may exceed $2 billion annually. Moreover, the skilled personnel related to SSD have a very high economic multiplier. Thus, indirect damages from losing SSD would be about three times greater than the direct impact.

While losing Space Systems Division would be devastating, the competitive advantages accruing from its retention are immense. It offers the defense component of our economy a chance to rebuild in an area that will grow in importance over time. And, although space work involves production, it does not have the same deleterious impact on air quality as "smoke stack

industries." Rather, it features low volume and exceedingly high value items which would keep the County on the cutting edge of key future technologies.

Defense Contractor Conversion
Many political or philosophical opponents of defense spending regard the end of the cold war as an opportunity to convert defense resources to more beneficial uses. This is a realistic long term objective. But too little attention is paid to problems of converting large firms that are primarily or exclusively defense prime contractors to achieving profitability in the commercial marketplace. Conversion is simply not a credible near term alternative for them because it would require profound changes for every aspect of a firm.[20] Some differences that exist between the defense and commercial marketplaces are summarized in the following table.

IMPEDIMENTS TO DEFENSE CONTRACTOR CONVERSION		
CHARACTERISTIC	**DEFENSE**	**COMMERCIAL**
Customer	One	Many
Product Origin	Customer Requirement	Firm Initiative
Development Time	Several Years	Few Months
Production Quantity	Low	High
Market	Cost Driven	Price Driven
Risk/Reward	Low-Med/Low	High/High
Regulation	High	Low

Overcoming those obstacles is not feasible in the near term. A recent study by Michael C. Lambert of Bradley-Lambert and Dr. Sam Hariharan of USC confirmed that this perception is also shared by local defense firm managers. The most frequent response given by defense companies queried about their diversification plans was that they had none. Rather, they indicated that their efforts were focused on becoming more competitive and better serving key defense customers.

Thus, defense firms plan on staying in the defense business. Whether they will stay in Los Angeles County is an issue. Although the County lost its dominant position in defense during the 80's, it is still the leader. But prompt and decisive action is required to maintain its status as a center of excellence. Anything less will cause the local defense industry to assume a supporting role.

RECOMMENDATIONS

Three important realities should guide the design of strategies to retain the defense-related industrial base of the region:

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[20]These impediments are not nearly so severe for firms which already have a strong mix of commercial and defense business.

- The bulk of the defense industry consists of large firms performing large contracts.

- Los Angeles County's traditional strengths in aircraft and missiles have been severely eroded. It is highly improbable, if not inconceivable, that they will be regained in an era of severe constraints on the Department of Defense budget.

- Los Angeles County has retained a strong Research Development Test and Evaluation capability. However, without a viable production base to support it, this capability will soon dissipate.

Therefore, if the County is to retain a competitive advantage in the defense marketplace, large programs must be obtained that do not depend upon high rate manufacturing.

The Strategic Defense Initiative may offer the solution to maintaining Los Angeles County's dominant position in defense and aerospace. Although data are sketchy due to the fragmented and classified nature of projects included under the Strategic Defense Initiative umbrella, Los Angeles County has several key firms working on this program. They include Aerospace Corporation, Hughes Aircraft, McDonnell Douglas, Rockwell, and TRW. These firms are on the cutting edge of technologies that should yield payoffs in electronics, communications, and optics. Furthermore, these projects involve low rate, highly sophisticated manufacturing processes.

Two actions are required to retain the key firms that embody Los Angeles County's future prospects for remaining competitive in the defense market:

1. Los Angeles County should offer a climate for performing defense research and development that, on balance, does not drive major entrenched firms away to greener pastures. This means that these firms must perceive an improvement in the County's business environment.

2. Policy makers should take positive action to ensure that the Air Force Space Systems Division is retained. In particular, efforts should be made to help provide the 250 units of affordable family housing SSD needs. It is recommended that the concept developed by the State of California, Los Angeles County Community Development Commission, South Bay cities, City of Los Angeles, and the South Bay Chamber of Commerce be endorsed and carried out.

TABLES

Table 1 DoD Contract Awards to LA Co. Cities and Communities 1987-1990

CITY/COMMUNITY	FY87 Total	FY88 Total	FY89 Total	FY90 Total	87-90 Total	Rank
Agoura Hills	762	585	814	170	2,331	72
Alhambra	2,266	1,321	1,627	1,698	6,912	58
Arcadia	5,305	785	1,115	2,474	9,679	51
Artesia					0	107
Avalon					0	108
Azusa	234,108	284,729	342,491	855,564	1,716,892	7
Baldwin Park	1,116	1,040	632	2,095	4,883	64
Bell	957	8,188	964	74	10,183	50
Bell Gardens	14,769	6,456	9,591	8,071	38,887	33
Bellflower	206	27	33	10	276	92
Beverly Hills	2,648	1,764	666	1,434	6,512	60
Bradbury					0	109
Burbank	389,437	401,957	365,991	642,646	1,800,031	6
Carson	279,192	307,821	15,113	9,999	612,125	12
Cerritos	12,567	1,870	1,516	2,112	18,065	42
Claremont	525	932	1,124	754	3,335	69
Commerce	3,182	1,640	1,900	4,495	11,217	48
Compton	21,136	15,836	26,591	14,415	77,978	25
Covina	1,246	2,274	3,737	4,453	11,710	47
Cudahy	295	272	9,803	122	10,492	49
Culver City	30,185	25,985	25,040	10,866	92,076	22
Diamond Bar	41,229	4,637	4,613	2,866	53,345	26
Downey	464,586	229,041	254,750	99,203	1,047,580	8
Duarte	10,251	13,890	14,400	4,409	42,950	29
El Monte	78,417	37,252	188,686	58,150	362,505	13
El Segundo	1,464,215	1,465,325	1,166,935	1,036,388	5,132,863	3
Gardena	30,533	37,753	23,224	17,881	109,391	19
Glendale	49,268	38,093	20,584	17,265	125,210	18
Glendora	1,106	536	803	960	3,405	68
Hawaiian Gardens	26				26	106
Hawthorne	348,342	222,635	124,221	133,362	828,560	11
Hermosa Beach	10,300	8,366	7,340	2,026	28,032	35
Hidden Hills					0	110
Huntington Park	9,358	10,353	16,867	10,550	47,128	27
Industry	31,103	57,921	76,294	47,015	212,333	17
Inglewood	27,632	21,221	13,165	23,548	85,566	24
Irwindale	1,873	555	837	932	4,197	66
La Canada Flintridge	568	482	158	157	1,365	77
La Habra Heights		127			127	94
La Mirada	602	670	2,965	2,571	6,808	59
La Puente			34	73	107	96

1 Source: Beltramo and Associates

Table 1 DoD Contract Awards to LA Co. Cities and Communities 1987-1990

CITY/COMMUNITY	FY87 Total	FY88 Total	FY89 Total	FY90 Total	87-90 Total	Rank
La Verne	156	158	610	183	1,107	80
Lakewood	305	948	378	1,557	3,188	70
Lancaster	53				53	102
Lawndale	25	209	(5)	77	306	91
Lomita	865	291		133	1,289	79
Long Beach	1,191,231	2,477,239	2,250,098	1,537,642	7,456,210	2
Los Angeles	2,510,021	1,978,665	2,138,409	2,243,208	8,870,303	1
Lynwood	1,313	3,854	1,409	1,402	7,978	55
Malibu	16,735	13,230	10,570	5,620	46,155	28
Manhattan Beach	9,054	3,445	5,278	1,758	19,535	40
Maywood	279	262	176	277	994	82
Monrovia	4,840	4,762	17,144	11,164	37,910	34
Montebello	1,301	1,312	1,520	1,839	5,972	61
Monterey Park	166	375	4,599	221	5,361	63
Norwalk	2,617	4,098	3,823	4,936	15,474	43
Palmdale	119,674	134,931	201,287	546,558	1,002,450	9
Palos Verdes Estates		1,548	346	105	1,999	75
Paramount	7,254	1,330	978	37	9,599	52
Pasadena	74,763	98,095	67,806	76,688	317,352	15
Pico Rivera	6,040	13,335	2,221	2,680	24,276	36
Pomona	1,217,573	581,252	307,123	404,229	2,510,177	5
Rancho Palos Verdes	73	225	62	385	745	85
Redondo Beach	670,184	726,098	833,399	563,258	2,792,939	4
Rolling Hills	701	451	603	257	2,012	74
Rolling Hills Est	3,523	1,346	348	1,958	7,175	57
Rosemead	82	258	425	237	1,002	81
San Dimas	1,602	1,170	3,517	1,906	8,195	54
San Fernando	8,864	8,460	16,200	5,736	39,260	32
San Gabriel	534	126	1,022	487	2,169	73
San Marino					0	111
Santa Clarita					0	112
Santa Fe Springs	21,110	58,863	17,616	11,464	109,053	20
Santa Monica	107,781	63,676	64,286	91,446	327,189	14
Sierra Madre	11,436	6,279	1,635	3,876	23,226	37
Signal Hill	0	87	282	28	397	87
South El Monte	10,280	19,764	6,371	5,405	41,820	31
South Gate	1,641	3,778	2,456	497	8,372	53
South Pasadena	748	344	200	305	1,597	76
Temple City		28			28	104
Torrance	272,321	266,386	191,939	200,164	930,810	10
Vernon	9,934	2,773	1,099	5,977	19,783	39

2 Source: Beltramo and Associates

Table 1 DoD Contract Awards to LA Co. Cities and Communities 1987-1990

CITY/COMMUNITY	FY87 Total	FY88 Total	FY89 Total	FY90 Total	87-90 Total	Rank
Walnut	1,895	2,044	2,390	1,390	7,719	56
West Covina	20,484	9,442	7,317	4,902	42,145	30
West Hollywood	28				28	105
Westlake Village	61,773	53,092	46,851	62,628	224,344	16
Whittier	3,230	2,439	4,167	4,330	14,166	44
TOTAL CITIES	$9,941,800	$9,758,807	$8,940,579	$8,825,758	$37,466,944	
Agnew				550	550	86
Altadena	282	82	487	80	931	83
Calabasas	1,213	5,159	4,764	7,136	18,272	41
Channel Islands				359	359	89
Channel Islands Nati		260	3,786		4,046	67
Charter Oak	64	228	72		364	88
Fairmont				102	102	97
Florence	36	243	835	179	1,293	78
Hilarita	73				73	100
La Crescenta-Montros	220	89			309	90
Ladera Heights	1,912	750			2,662	71
Marina del Ray	32,742	26,303	21,075	16,309	96,429	21
Newhall	20,875	704	894	57	22,530	38
North Hills	194				194	93
Saugus		69		46	115	95
Saugus-Bouquet				5,695	5,695	62
Saugus-Bouquet Canyo	4,251	4,240	3,461		11,952	46
Solemint	417	11,659	49	729	12,854	45
Sun Village		47	46		93	99
Sylvia Park	60				60	101
Universal City	1,492	1,327	716	1,031	4,566	65
Val Verde Park	29				29	103
Valencia	27,299	23,207	16,880	23,419	90,805	23
West Puente Valley	812				812	84
Whittier Junction	(39)				(39)	113
Willowbrook	99				99	98
TOTAL UNICORPATED	$92,031	$74,367	$53,065	$55,692	$275,155	
TOTAL ALL	$10,033,831	$9,833,174	$8,993,644	$8,881,450	$37,742,099	

3 Source: Beltramo and Associates

Table 2 DoD Contract Awards to LA Co. Statistical Areas 1987-1990

SA	LOCATION	FY87 Total	FY88 Total	FY89 Total	FY90 Total	87-90 Total	Ran
1	Adams	84,153	77,978	69,752	50,109	281,992	17
2	Avalon		260	3,786	359	4,405	33
3	Beverly Hills	51,612	100,472	59,767	65,080	276,931	18
4	Burbank	403,986	412,078	377,332	651,028	1,844,424	5
5	Calabasas	63,808	58,836	52,429	70,484	245,557	20
6	Chatsworth	1,261,494	901,275	925,447	930,917	4,019,133	3
7	Citrus	259,997	298,804	355,889	868,906	1,783,596	6
8	Compton	22,548	19,690	28,000	15,817	86,055	26
9	Central	3,764	33,027	2,668	28,743	68,202	27
10	LA Harbor	430,718	394,456	74,710	62,530	962,414	11
11	East	107				107	34
12	El Monte	88,658	57,016	195,057	63,555	404,286	15
13	Central Valley	188,456	153,811	195,154	47,355	584,776	13
14	Glendale	49,488	38,182	27,735	26,631	142,036	23
15	Hollywood	28				28	35
16	Inglewood	437,909	295,692	214,457	225,859	1,173,917	7
17	Long Beach	1,194,563	2,481,807	2,251,471	1,539,227	7,467,068	2
18	Monrovia	31,832	25,744	34,294	21,923	113,793	25
19	Malibu	16,735	13,230	10,570	5,620	46,155	28
20	North County	168,347	170,548	219,156	570,865	1,128,916	8
21	Northeast	7,792	6,279	9,120	5,447	28,638	30
22	Norwalk	494,023	240,352	261,547	108,804	1,104,726	9
23	Palos Verdes	277,483	270,247	193,298	203,002	944,030	12
24	Pasadena	75,613	98,659	68,451	76,925	319,648	16
25	Pomona	1,219,856	583,512	312,374	407,072	2,522,814	4
26	Puente Hills	75,039	64,602	83,331	51,344	274,316	19
27	San Fernando	34,029	34,794	33,772	37,711	140,306	24
28	San Gabriel	3,796	2,424	7,873	2,948	17,041	32
30	Santa Monica	141,272	90,888	86,747	107,968	426,875	14
31	South Bay	2,503,273	2,520,139	2,542,406	2,337,097	9,902,915	1
32	South East	59,068	42,224	55,468	38,466	195,226	21
33	Tujunga	42,222	(328)	3,360	135	45,389	29
34	Whittier	33,276	77,234	28,596	24,001	163,107	22
35	Wilshire	9,576	12,626	674	793	23,669	31
LA	Other LA	299,310	256,616	208,953	234,729	999,608	10
	TOTAL	$10,033,831	$9,833,174	$8,993,644	$8,881,450	$37,742,099	

1 Source: Beltramo and Associates

Table 3 | Summary of Top DoD Products and Services for LA Co. and National

Code	PRODUCT	LACo Rank	Natl Rank	89 Location	90 Quotients	LA FY87 Total	LA FY88 Total	LA FY89 Total	LA FY90 Total	LA 87-90 Total	Natl FY89 Total	Natl FY90 Total	Natl 89-90 Total
58	Comm, Detect, & Coher Rad Eqp	1	2	1.934	0.977	602,783	360,070	1,220,954	443,978	2,627,851	10,126,522	9,158,530	19,285,052
14	Guided Missiles	2	3	0.859	1.411	988,245	533,192	492,090	503,576	2,517,124	9,189,329	7,189,413	16,378,742
15	AC & Airframe Struct	3	1	0.257	0.960	441,664	534,622	167,935	586,620	1,730,863	10,476,665	12,319,677	22,796,342
16	AC Components & Access	4	8	1.662	4.139	659,428	272,738	276,245	492,355	1,700,800	2,666,098	2,397,053	5,063,151
91	Fuels, Lubs, Oils, Waxes	5	6	1.170	0.294	572,776	596,275	253,563	55,658	1,478,374	3,474,449	3,818,475	7,292,924
18	Space Vehicles	6	16	7.768	4.138	200,186	267,400	609,921	165,111	1,242,671	1,259,242	804,154	2,063,396
13	Ammo & Explosives	7	7	1.489	0.480	511,149	237,089	209,521	71,310	1,029,096	2,256,049	2,995,388	5,251,437
12	Fire Control Equip	8	12	3.380	3.407	287,020	191,103	245,028	248,996	972,186	1,162,433	1,472,652	2,635,085
10	Weapons	9	14	0.891	1.370	461,683	166,583	53,848	86,331	768,480	969,074	1,269,700	2,238,774
66	Instru & Lab Equip	10	15	1.525	2.787	213,668	123,109	105,881	144,636	587,389	1,113,659	1,045,636	2,159,295
	TOTAL - PRODUCTS					$5,955,866	$4,049,461	$4,232,569	$3,339,776	$17,577,672	$67,877,763	$67,301,108	$135,178,871
AC	Defense Sys	1	1	1.102	1.066	1,902,233	3,478,985	2,799,323	2,571,035	10,751,581	15,969,633	14,667,403	30,637,036
AR	Space	2	4	2.156	2.356	531,352	592,060	453,673	520,341	2,097,437	1,322,754	1,343,479	2,666,233
AD	Defense Other	3	2	0.647	0.728	338,451	409,180	327,212	443,453	1,518,303	3,179,753	3,703,102	6,882,855
	TOTAL - RDT&E					$2,841,005	$4,528,366	$3,659,762	$3,609,934	$14,639,067	$23,001,895	$21,960,040	$44,961,935
R	Prof Tech & Mgt Svc	1	1	2.096	3.065	385,391	311,813	353,143	1,095,858	2,146,215	4,485,599	6,005,267	10,490,866
J	Maint & Rep of Equip	2	2	0.973	0.762	254,582	262,081	158,619	261,448	936,736	4,340,276	5,767,123	10,107,399
Y	Const Facil Struct	3	3	1.080	1.406	67,244	177,367	183,052	263,648	691,321	4,511,421	3,149,221	7,660,642
V	Transp & Travel	4	8	2.567	0.106	161,629	162,511	101,400	14,039	439,594	1,051,877	2,235,227	3,287,104
K	Mod of Equip	5	9	2.298	0.659	50,035	185,816	136,290	46,253	418,412	1,579,367	1,178,233	2,757,600
	TOTAL - SERVICES					$1,236,960	$1,255,347	$1,101,313	$1,931,740	$5,525,360	$29,327,079	$32,450,631	$61,777,710
	TOTAL - ALL					$10,033,831	$9,833,174	$8,993,644	$8,881,450	$37,742,099	$120,206,737	$121,711,779	$241,918,516

Source: Beltramo and Associates

Table 4

DoD Contract Awards to LA Co. for RDT&E 1987-1990

CODE	DESCRIPTION	FY87 Total	FY88 Total	FY89 Total	FY90 Total	87-90 Total
AC1		$1,177,136	$2,695,816	$2,178,298	$2,056,296	$8,107,546
AC11	RDTE/AIRCRAFT-BASIC RESEARCH	21,069	8,381		427	29,877
AC12	RDTE/AIRCRAFT-EXPLORATORY DEVELOPMENT	2,314	3,955	1,380	2,426	10,075
AC13	RDTE/AIRCRAFT - ADVANCED DEVELOPMENT	157,242	226,499	387,724	835,954	1,607,419
AC14	RDTE/AIRCRAFT - ENGINEERING DEVELOPMENT	959,487	2,393,650	1,514,171	1,198,133	6,065,441
AC15	RDTE/AIRCRAFT-OPERATIONAL SYSTEMS DEVELOPMENT	34,253	62,914	259,153	18,802	375,122
AC16	RDTE/AIRCRAFT - MANAGEMENT & SUPPORT	2,771	417	15,870	554	19,612
AC2		$388,673	$373,073	$330,962	$170,153	$1,262,861
AC21	RDTE/MISSILE AND SPACE SYSTEMS-BASIC RESEARCH	1,279	9,313	2,023	14,551	27,166
AC22	RDTE/MISSILE AND SPACE SYSTEMS-EXPLORATORY DEVELO	26,020	16,246	13,401	33,973	89,640
AC23	RDTE/MISSILE AND SPACE SYSTEMS-ADVANCED DEVELOP	84,361	52,553	81,769	64,030	282,713
AC24	RDTE/MISSILE AND SPACE SYSTEMS-ENGR DEVELOPMENT	247,711	270,819	169,379	49,137	737,046
AC25	RDTE/MISSILE AND SPACE SYSTEMS-OP SYSTEMS DEVELOP	27,472	21,738	62,856	6,599	118,665
AC26	RDTE/MISSILE AND SPACE SYSTEMS-MGMT & SUPPORT	1,830	2,404	1,534	1,863	7,631
AC3		$47,638	$92,680	$1,145	$797	$142,260
AC31	RDTE/SHIPS-BASIC RESEARCH	99		48	199	346
AC32	RDTE/SHIPS - EXPLORATORY DEVELOPMENT	398	185	217	551	1,351
AC33	RDTE/SHIPS - ADVANCED DEVELOPMENT	909	1,025	38		1,972
AC34	RDTE/SHIPS - ENGINEERING DEVELOPMENT	17,327	67,547	842		85,716
AC35	RDTE/SHIPS - OP SYSTEMS DEVELOPMENT					
AC36	RDTE/SHIPS - MANAGEMENT & SUPPORT	28,905	23,923		47	52,875
AC4		$4,051	$2,499	$1,140	$8,995	$16,685
AC41	RDTE/TANK - AUTOMOTIVE-BASIC RESEARCH					
AC42	RDTE/TANK - AUTOMOTIVE-EXPLORATORY DEVELOPMENT	3,514	2,515	740	1,121	7,890
AC43	RDTE/TANK - AUTOMOTIVE-ADVANCED DEVELOPMENT	299		400	1,463	2,162
AC44	RDTE/TANK - AUTOMOTIVE - ENGR DEVELOPMENT	238	47			285
AC45	RDTE/TANK - AUTOMOTIVE - OP SYS DEVELOP		(63)			(63)
AC46	RDTE/TANK - AUTOMOTIVE-MANAGEMENT & SUPP				6,411	6,411
AC5		$92,017	$60,973	$48,842	$54,475	$256,307
AC51	RDTE/WEAPONS-BASIC RESEARCH	343	150		93	586
AC52	RDTE/WEAPONS - EXPLORATORY DEVELOPMENT	3,566	2,697	909	970	8,142
AC53	RDTE/WEAPONS - ADVANCED DEVELOPMENT	74,996	56,766	44,939	43,060	219,761

Source: Beltramo and Associates

Table 4

DoD Contract Awards to LA Co. for RDT&E 1987-1990

CODE	DESCRIPTION	FY87 Total	FY88 Total	FY89 Total	FY90 Total	87-90 Total
AC54	RDTE/WEAPONS - ENGINEERING DEVELOPMENT	3,796	2,547	2,496	10,183	19,022
AC55	RDTE/WEAPONS-OPERATIONAL SYSTEMS DEVELOPMENT		1,991	397	117	2,505
AC56	RDTE/WEAPONS - MANAGEMENT & SUPPORT	9,316	(3,178)	101	52	6,291
AC6		$189,634	$252,642	$232,219	$276,466	$950,961
AC61	RDTE/ELECTRONICS & COMMUNICATION EQ-BASIC RESEARC	13,212	10,938	11,770	8,678	44,598
AC62	RDTE/ELECTRONICS & COMMUNICATION EQ-EXPLOR DEVEL	17,073	14,710	29,363	24,133	85,279
AC63	RDTE/ELECTRONICS & COMMUNICATION EQ-ADVANCED DEV	52,672	46,521	61,183	40,408	200,784
AC64	RDTE/ELECTRONICS & COMMUNICATION EQ-ENGR DEVELOP	57,383	85,438	74,460	80,735	298,016
AC65	RDTE/ELECTRONICS & COMMUNICATION EQ-OP SYSTEMS D	49,113	94,250	54,471	116,821	314,655
AC66	RDTE/ELECTRONICS & COMMUNICATION EQ-MGMT & SUPPO	181	785	972	5,691	7,629
AC9		$3,084	$1,302	$6,717	$3,853	$14,956
AC91	RDTE/MISC HARD GOODS-BASIC RESEARCH				2,978	2,978
AC92	RDTE/MISC HARD GOODS - EXPLORATORY DEVELOP	1,192	657	407	327	2,583
AC93	RDTE/MISC HARD GOODS - ADVANCED DEVELOP	631	68		51	750
AC94	RDTE/MISC HARD GOODS - ENGR DEVELOPMENT	178		5,800		5,978
AC95	RDTE/MISC HARD GOODS - OP SYSTEMS DEVELOP	1,083	177	202		1,462
AC96	RDTE/MISC HARD GOODS - MGMT & SUPPORT		400	308	497	1,205
	TOTAL	$1,902,233	$3,478,985	$2,799,323	$2,571,035	$10,751,576

Source: Beltramo and Associates

Table 5 - Largest Defense Programs in LA Co. - 199[illegible]

WEAPON SYSTEM	CONTRACTOR	CITY	FSC/SERVICE DESCRIPTION	SYS TOT	CONT TOT
C-17 CARGO TRANSPORT				$1,181,814	
	MC DONNELL DOUGLAS CORPOR	Long Beach	RDTE/AIRCRAFT - ENGINEERING DEVELOPMENT		808,752
			MISCL AIRCRAFT ACCESSORIES COMPONENTS		257,653
			AIRCRAFT FIXED WING		115,409
P-7A (PRESUMED)				$434,673	
	LOCKHEED CORPORATION				
		Burbank	RDTE/AIRCRAFT - ADVANCED DEVELOPMENT		281,119
		Palmdale	RDTE/AIRCRAFT - ENGINEERING DEVELOPMENT		153,554
B-2 (PRESUMED)				$332,600	
	NORTHROP CORPORATION	Palmdale	RDTE/AIRCRAFT - ADVANCED DEVELOPMENT		332,600
B-1				$270,169	
	ROCKWELL INTERNATIONAL CORP	El Segundo	SYSTEMS ENGINEERING SERVICES		26,129
			PROGRAM MANAGEMENT/SUPPORT SERVICES		63,171
		Los Angeles	MODIFICATION OF EQ/MISCELLANEOUS EQUIPMENT		14,450
			SYSTEMS ENGINEERING SERVICES		11,375
			RDTE/AIRCRAFT-OPERATIONAL SYSTEMS DEVELOPMENT		5,000
			MAINT & REPAIR OF EQ/MISCELLANEOUS EQUIPMENT		10,103
			AIRCRAFT FIXED WING		34,133
			RDTE/AIRCRAFT - ENGINEERING DEVELOPMENT		77,023
			PROGRAM MANAGEMENT/SUPPORT SERVICES		14,786
			AIRFRAME STRUCTURAL COMPONENTS		15,227
	SIERRACIN CORPORATION	Los Angeles	AIRFRAME STRUCTURAL COMPONENTS		4,752
	TRW INC	Redondo Beach	SYSTEMS ENGINEERING SERVICES		2,044
C-130 HERCULES				$249,214	
	ALLIED SIGNAL AEROSPACE CO	Torrance	AIRCRAFT AIR CONDITIONING HEATING EQUIP		3,780
	ROCKWELL INTERNATIONAL CORP	Los Angeles	ANTENNAS WAVEGUIDES & RELATED EQUIPMENT		4,520
			AIRCRAFT GUNNERY FIRE CONTROL COMPONENTS		2,475
			RADIO AND TV COMM EQUIPMENT AIRBORNE		7,732
			AIRCRAFT FIXED WING		196,843
			MISCELLANEOUS COMMUNICATION EQUIPMENT		12,314
			RDTE/AIRCRAFT-OPERATIONAL SYSTEMS DEVELOPMENT		10,711
MX-MISSILE				$157,840	
	EARTH TECHNOLOGY CORPORATI	Long Beach	RDTE/MISSILE AND SPACE SYSTEMS-ENGR DEVELOPMENT		3,097
	LITTON SYSTEMS INC	Los Angeles	RDTE/MISSILE AND SPACE SYSTEMS-ENGR DEVELOPMENT		8,703
	LOGICON INC	Los Angeles	RDTE/MISSILE AND SPACE SYSTEMS-ENGR DEVELOPMENT		5,674
	NORTHROP CORPORATION	Hawthorne	GUIDED MISSILE COMPONENTS		10,655
	ROCKWELL INTERNATIONAL CORP	Hawthorne	GUIDED MISSILE COMPONENTS		65,015
		Los Angeles	GUIDED MISSILE SUBSYSTEMS		61,606
ADVANCED TACTICAL FIGHTER				$155,360	
	LOCKHEED CORPORATION	Burbank	RDTE/AIRCRAFT - ADVANCED DEVELOPMENT		100,216
	NORTHROP CORPORATION	Palmdale	RDTE/AIRCRAFT - ADVANCED DEVELOPMENT		48,144
	TRW INC	Redondo Beach	RDTE/ELECTRONICS & COMMUNICATION EQ-ENGR DEVELOP		7,000
UGM-96 TRIDENT				$144,245	
	HUGHES AIRCRAFT COMPANY	El Segundo	RDTE/MISSILE AND SPACE SYSTEMS-BASIC RESEARCH		13,842
			GUIDED MISSILE COMPONENTS		10,000
			RDTE/MISSILE AND SPACE SYSTEMS-ENGR DEVELOPMENT		10,000
			MAINT & REPAIR OF EQ/GUIDED MISSILES		46,566
			GUIDED MISSILE SYSTEMS COMPLETE		44,267
	LITTON SYSTEMS INC	Los Angeles	RDTE/MISSILE AND SPACE SYSTEMS-ENGR DEVELOPMENT		2,986
			GUIDED MISSILE SYSTEMS COMPLETE		15,518
T-45 GOSHAWK				$143,581	
	MC DONNELL DOUGLAS CORPOR	Long Beach	RDTE/AIRCRAFT - ENGINEERING DEVELOPMENT		142,821
F-18 HORNET				$134,825	
	ALLIED SIGNAL INC	Los Angeles	ELCT COUNTERMEASURES & QUICK REACTION EQ		3,950
	H R TEXTRON INC	Valencia	MISCL AIRCRAFT ACCESSORIES COMPONENTS		3,000
	HUGHES AIRCRAFT COMPANY	Long Beach	GUIDED MISSILE REMOTE CONTROL SYSTEMS		2,292
	HUGHES AIRCRAFT COMPANY	Los Angeles	MAINT & REPAIR OF EQ/COMMUNICATION EQUIPMENT		6,265
			GUIDED MISSILE REMOTE CONTROL SYSTEMS		7,499
			AIRCRAFT BOMBING FIRE CONTROL COMPONENTS		43,743
			MICROCIRCUITS - ELECTRONIC		8,069
	LITTON SYSTEMS INC	Los Angeles	NAVIGATIONAL INSTRUMENTS		2,916
			RDTE/ELECTRONICS & COMMUNICATION EQ-ENGR DEVELOP		34,422
	LUCAS WESTERN INC	City of Industry	GAS TURBINES AND JET ENGINES AIRCRAFT		10,407
P-3 ORION				$132,579	
	ALLIED SIGNAL AEROSPACE CO	Torrance	AIRCRAFT AIR CONDITIONING HEATING EQUIP		6,791
	LOCKHEED CORPORATION	Burbank	INSTALLATION OF EQ/AIRCRAFT STRUCTURAL C		4,873
			LOGISTICS SUPPORT SERVICES		2,362
			MISCL AIRCRAFT ACCESSORIES COMPONENTS		6,743
			AIRCRAFT FIXED WING		94,312
			MAINT & REPAIR OF EQ/AIRCRAFT STRUCTURAL		13,751
F-15 EAGLE				$121,753	
	HI SHEAR CORPORATION	Torrance	MISCL AIRCRAFT ACCESSORIES COMPONENTS		2,139
	HUGHES AIRCRAFT COMPANY	El Segundo	CONVERTERS ELECTRICAL NONROTATING		5,846
			MSC ELECTRICAL AND ELECTRONIC COMPONENTS		2,231
			RADAR EQUIPMENT AIRBORNE		58,311
		Long Beach	MISCL AIRCRAFT ACCESSORIES COMPONENTS		4,900
			RADAR EQUIPMENT AIRBORNE		6,718
		Los Angeles	RADAR EQUIPMENT AIRBORNE		24,639
			SYSTEMS ENGINEERING SERVICES		10,481
			MAINT & REPAIR OF EQ/COMMUNICATION EQUIPMENT		2,881
MK15 CLOSE IN WPN SYS				$114,673	
	GENERAL DYNAMICS CORPORATI	Pomona	ENGINEERING TECHNICAL SERVICES		3,362

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Source: Beltramo and Associat[illegible]

Table 5

Largest Defense Programs in LA Co. - 1990

WEAPON SYSTEM	CONTRACTOR	CITY	FSC/SERVICE DESCRIPTION	SYS TOT	CONT TOT
			A&E PRODUCTION ENGINEERING SERVICES		33,693
			GUNS THROUGH 30 MM		75,253
STRATEGIC DEFENSE INITIATIVE				$106,384	
	AEROJET GENERAL CORPORATIO	Azusa	RDTE/MISSILE AND SPACE SYSTEMS-ADVANCED DEVELOP		2,228
	ALLIED SIGNAL AEROSPACE CO	Torrance	RDTE/MISSILE AND SPACE SYSTEMS-ADVANCED DEVELOP		5,903
	HUGHES AIRCRAFT COMPANY	El Segundo	RDTE/WEAPONS - ADVANCED DEVELOPMENT		7,998
			RDTE/MISSILE AND SPACE SYSTEMS-ADVANCED DEVELOP		2,602
	HUGHES AIRCRAFT COMPANY	Los Angeles	RDTE/MISSILE AND SPACE SYSTEMS-ADVANCED DEVELOP		2,702
	PHYSICAL RESEARCH INC	Torrance	RDTE/OTHER DEFENSE - EXPLORATORY DEVELOP		2,700
	ROCKWELL INTERNATIONAL CORP	Los Angeles	RDTE/MISSILE AND SPACE SYSTEMS-EXPLORATORY DEVELOP		6,000
	S SYSTEMS CORPORATION	El Segundo	RDTE/MISSILE AND SPACE SYSTEMS-ADVANCED DEVELOP		4,247
	TRW INC	Redondo Beach	RDTE/WEAPONS - ADVANCED DEVELOPMENT		22,167
			RDTE/MISSILE AND SPACE SYSTEMS-ADVANCED DEVELOP		19,430
			RDTE/OTHER DEFENSE - ADVANCED DEVELOPMENT		5,128
F-14 TOMCAT				$103,408	
	ALLIED SIGNAL AEROSPACE CO	Carson	MAINT & REPAIR OF EQ/AIRCRAFT COMPS & ACCYS		2,964
	HUGHES AIRCRAFT COMPANY	El Segundo	RDTE/ELECTRONICS & COMMUNICATION EQ-ENGR DEVELOP		7,900
			A&E MANAGEMENT ENGINEERING SERVICES		3,650
		Long Beach	GUIDED MISSILE REMOTE CONTROL SYSTEMS		2,715
		Los Angeles	RADAR EQUIPMENT AIRBORNE		69,100
		Torrance	MAINT & REPAIR OF EQ/ELECTRICAL & ELCT EQUIP COMPS		13,694
S-3 VIKING				$84,248	
	ALLIED SIGNAL AEROSPACE CO	Torrance	MISCL AIRCRAFT ACCESSORIES COMPONENTS		2,236
	LOCKHEED CORPORATION	Burbank	MISCELLANEOUS PRINTED MATTER		2,123
			MISCL AIRCRAFT ACCESSORIES COMPONENTS		12,647
			INSTALLATION OF EQ/AIRCRAFT STRUCTURAL C		43,957
			MODIFICATION OF EQ/AIRCRAFT STRUCTURAL COMPS		13,008
	TELEDYNE INDUSTRIES INC	Los Angeles	MISCELLANEOUS COMMUNICATION EQUIPMENT		2,550
C-10				$82,105	
	MC DONNELL DOUGLAS CORPOR	Long Beach	PROGRAM MANAGEMENT/SUPPORT SERVICES		80,458
F-16 FALCON				$80,802	
	HUGHES AIRCRAFT COMPANY	West Covina	OPERATIONAL TRAINING DEVICES		2,109
	LITTON SYSTEMS INC	Los Angeles	MAINT & REPAIR OF EQ/INSTRUMENTS & LAB EQUIPMENT		5,119
			NAVIGATIONAL INSTRUMENTS		25,411
	NAVCOM DEFENSE ELECTRONICS	El Monte	RADAR EQUIPMENT AIRBORNE		6,708
	PLASTICS RESEARCH CORPORATI	Santa Fe Springs	SPECIALIZED SHIPPING & STORAGE CONTAINERS		3,583
	SARGENT FLETCHER COMPANY	El Monte	AIRFRAME STRUCTURAL COMPONENTS		11,997
	SIERRACIN CORPORATION	Los Angeles	AIRFRAME STRUCTURAL COMPONENTS		7,390
	TELEDYNE INDUSTRIES INC	Los Angeles	AIRCRAFT GUNNERY FIRE CONTROL COMPONENTS		7,098
AH-64 APACHE				$66,752	
	H R TEXTRON INC	Valencia	AIRCRAFT HYDRAULIC VACUUM DE-ICING COMPS		3,534
	LORAL CORPORATION	Pomona	ARMAMENT TRAINING DEVICES		51,462
UH-60 UTTAS BLACKHAWK				$63,864	
	HUGHES AIRCRAFT COMPANY	El Segundo	MISCL AIRCRAFT ACCESSORIES COMPONENTS		59,111
CCPDS - REPLACE. PROG/NOR				$58,386	
	TRW INC	Redondo Beach	RDTE/ELECTRONICS & COMMUNICATION EQ-OP SYSTEMS DEV		58,386
RIM-66 STANDARD MISSILE(M				$58,368	
	GENERAL DYNAMICS CORPORATI	Pomona	MAINT & REPAIR OF EQ/GUIDED MISSILES		3,600
			RDTE/MISSILE AND SPACE SYSTEMS-ENGR DEVELOPMENT		2,533
			GUIDED MISSILES		44,159
			GUIDED MISSILE COMPONENTS		7,119
LGM-30 MINUTEMAN				$47,371	
	LOGICON INC	Los Angeles	SYSTEMS ENGINEERING SERVICES		6,910
	TRW INC	Redondo Beach	ENGINEERING TECHNICAL SERVICES		2,389
			SYSTEMS ENGINEERING SERVICES		35,824
AMRAAM				$45,652	
	HUGHES AIRCRAFT COMPANY	Los Angeles	GUIDED MISSILES		22,200
			LAUNCHERS GUIDED MISSILE		23,452
M-1 COMBAT 105MM GUN (ABR				$42,715	
	HUGHES AIRCRAFT COMPANY	El Segundo	OPTICAL SIGHTING AND RANGING EQUIPMENT		34,265
		Long Beach	OPTICAL SIGHTING AND RANGING EQUIPMENT		6,175
			TOTAL MAJOR WEAPON SYSTEMS	$4,413,381	

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Source: Beltramo and Associates

Chapter 3

GROWTH AND FUTURE PROSPECTS OF THE AEROSPACE-DEFENSE INDUSTRY IN LOS ANGELES COUNTY

by Allen J. Scott

SUMMARY OF FINDINGS

- **The aerospace-defense industry grew rapidly in Los Angeles County over the post-War decades. The industry suffered periodic cyclical downturns, but until the late 1980s, these downturns were always reversed by upturns in federal defense spending.**

- **The projected decline in defense spending over the 1990s will have a strongly negative impact on employment in Los Angeles County. This impact will be greatly magnified by multiplier effects extending from the aerospace-defense complex to other industries in the region.**

- **At the same time, there has been a long-term increase in the share of the County's employment base that is accounted for by non-defense jobs. This circumstance provides enhanced opportunities for viable local economic development strategies.**

- **Los Angeles is a focus of NASA as well as DoD procurement activity. Approximately half of the value of the NASA prime contracts received by local firms is subcontracted out. On the first-tier level, subcontracts leaving the County have a much higher total value than subcontracts entering it from prime contractors located in the rest of the country. On the second-tier level this pattern is reversed with a disproportionately large flow of subcontract orders entering the County from elsewhere.**

- **There is an actual and projected propensity on the part of larger aerospace producers to relocate significant amounts of employment to other parts of the country.**

- **The projected continued declines in federal defense spending will cause a steady erosion of the County's industrial base. However, the County's industrial complex has many latent strengths and these could provide a foundation for future growth. Concerted local economic development policies are essential if this growth is to be assured.**

INTRODUCTION

This chapter examines the past performance and future growth of the aerospace-defense industries of Los Angeles County. The chapter will also explore the possible direct and indirect impacts on the County's economy of a continued severe decline in federal defense spending. Issues to be discussed include the following:

1. Long-term growth characteristics of the region's high-technology industrial complex, and the capability of the complex to withstand the current cutbacks.

2. The direct and indirect impacts of defense spending on employment in the County.

3. The quantitative relationship between defense spending and employment in the County.

4. The intra- and inter-regional linkages of local aerospace-defense prime contractors, and the ways in which these linkages affect employment growth and decline.

5. Locational tendencies - current and projected - of defense-oriented producers.

HISTORICAL EMPLOYMENT PATTERNS AND PROSPECTIVE TRENDS

Overview of the Los Angeles Economy

Over the 1940s and 1950s, Los Angeles and the wider region of Southern California emerged as one of the world's largest manufacturing centers, with a booming and highly diversified economy. During the Second World War Los Angeles had become a major focus of the aircraft industry, and in the immediate post-War years, it also acquired a burgeoning electronics and missile manufacturing capacity. Indeed, well before the take-off of such celebrated high technology industrial centers as Silicon Valley or Boston's Route 128, Los Angeles was already firmly established as <u>the</u> premier growth region for technology-intensive manufacturing, and it is now unquestionably the biggest high technology industrial region in the United States, if not the world.[1]

The region's high technology industrial base over most of the post-War period was complemented by two other main ensembles of manufacturing activity. First, Los Angeles was an important focus of traditional mass production industries such as steel, cars, rubber tires, petroleum refining, and so on, though by the 1980s, most of these industries (with the exception of petroleum refining) had virtually disappeared from the local industrial landscape. Second, Los Angeles was also (as it is today) a leading location for such low

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[1] A. J. Scott, "The aerospace-electronics industrial complex of Southern California: the formative years, 1940 - 1960", <u>Research Policy</u>, 1991.

-technology labor-intensive industries as clothing, furniture, printing and publishing, and film-making. At the present time, these artisanal industries are among the most rapidly growing in the region[2].

Alongside this manufacturing employment base, a significant service sector developed in the 1970s and 1980s as Los Angeles became one of the primary banking, financial and commercial centers of the Pacific Rim. Indeed, services as a whole (including both personal and business services) now represent the largest employment sector in the region.

The County's employment pattern is thus both multifaceted and ever-changing. It has in the past successfully weathered a number of serious recessions, most particularly in the late 1940s and in the early 1970s, both of which (significantly enough) were provoked by drastic cutbacks in defense spending. We need to bear this sense of the region's fundamental dynamism clearly in mind as we now begin to explore the recent historical performance and future prospects of its aerospace-defense industrial base.

General Employment Patterns, 1972 - 1990

Total employment in Los Angeles County expanded by 46.2% from 2,896.1 thousand to 4,235.5 thousand between 1972 and 1989 (Table 1). Most of this expansion was accounted for by services which grew by as much as 106.0%, though manufacturing as a whole expanded by a reasonably healthy 15.1%. The latter figure is all the more encouraging in view of the circumstance that manufacturing employment in many other parts of the country, and especially in the Northeast of the United States declined absolutely over the same period. In fact, manufacturing employment reached its historic peak in Los Angeles in 1979 when 924.9 thousand workers were recorded, and it has declined slowly but fairly steadily to the present figure of 891.7 thousand. The high technology industrial ensemble reached its historic peak of employment in the County in 1987 (see below).

The performance of the manufacturing sector is actually very mixed when we examine its internal components (Table 2). Between 1972 and 1987, employment declined in such traditional sectors as petroleum and coal products, stone clay and glass products, and primary metal industries. By contrast, large employment increases were recorded in apparel and other textile products, printing and publishing, electric and electronic equipment, transportation equipment, and instruments and related products. These data are suggestive, again, of the vitality of several low- and high-technology industries in the region, though over the recent recessionary period of the late 1980s, even some of these industries (as we shall see) have been stagnant or have experienced decline.

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[2]A. J. Scott and A. Paul, "Industrial development and regional growth in Southern California, 1970 - 1987" pp. 57 - 111 in D. J. B. Mitchell and J. Wildhorn (eds.) Can California be Competitive and Caring? University of California, Los Angeles, Institute of Industrial Relations, Monograph and Research Series, No 49.

Defense Spending and High Technology Industrial Employment in Los Angeles County: 1972 - 1990

One of the immediate problems that we face in any attempt to describe the recent historical evolution of detailed segments of the US economy is the tendency for definitions within the official Standard Industrial Classification (SIC) to change at periodic intervals. Because of this tendency it is frequently impossible to obtain consistent data series over lengthy periods of time for particular sectors. In the recent past, there have been two major adjustments of the Standard Industrial Classification, one in 1972, and the other in 1987. Accordingly, most historical series examined here are for the period 1972 - 1987, with additional data given for the years after 1987 where comparability is possible (and where data are available). This circumstance makes it particularly difficult to decipher employment trends over the critical recent period since 1985 or 1986, though various special efforts will be made in what follows to compensate for this handicap.

The core high technology industrial complex of Los Angeles County is defined in Table 3 in terms of the 1972 and 1987 Standard Industrial Classifications[3]. As shown by the table, the complex is made up of an ensemble of computer, electronics, aerospace, and instruments industries. These industries do not account for all the high technology manufacturing in the County, nor do they account for all defense prime contract awards made to County firms; but they do account for a sufficiently high proportion of both local high technology industrial activity and defense purchases that we may safely take them as being fairly representative.

Defense and space prime contract awards in California and Los Angeles

It is difficult to judge precisely how much of the output of the core high technology industrial complex of Los Angeles County is sold directly and indirectly to the Department of Defense. One way of addressing this problem is to take national data on the proportion of each sector's output that is sold for defense purposes (as computed by the Office of Policy Analysis[4]) and pro-rate it over the high technology industries of Los Angeles County in proportion to employment. By this means, we estimate sales of output from the core complex for defense final demand to be 51.2% of the total (though this is almost certainly on the low side given the presumed greater concentration on defense of these industries in Los Angeles than in the country as a whole). Another way is through surveys, and as shown in Chapter 1, firms that responded to our mail questionnaire sold (on a weighted average basis) some 65.1.% of their output to the Department of Defense. Our working

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[3] The two definitions of the core complex as given in Table 3 differ from one another principally by the fact that several sub-sectors that were included in SIC 366 (communication equipment) in the 1972 Classification are reassigned to SIC 381 (search and navigation equipment) in 1987, though other minor discrepancies between the two definitions are also present. Strictly speaking, aggregate data for the complex in terms of the 1972 classification are not comparable to data for the complex in terms of the 1987 classification. However, the error term is not large (perhaps of the order of 10% at the most) and rough comparisons may be made providing due caution is exercised in drawing conclusions.

[4]Office of Policy Analysis, Industrial Output Effects of Planned Defense Spending, 1990 - 1994, Economics and Statistics Administration, US Department of Commerce,

assumption here, then, is that between 51.2% and 65.1% of core high technology employment in the County is directly dependent on defense spending, with the likelihood being that it is tilted towards the higher figure.

Department of Defense prime contracting activity as a whole declined greatly in real terms in the late 1960s and early 1970s, and then in the second half of the 1970s began a long upward climb which continued over much of the 1980s. By 1987, however, as an apparently durable international détente began to set in, total prime contract activity by the Department of Defense started to decline. The year-by-year record of total Department of Defense prime contract awards in both the United States and in the State of California is shown in Table 4 for the period 1972 - 1989. California has fairly consistently absorbed about 20% of these awards, though in recent years the percentage has been declining so that it is now 15% or 16%, and in fact, declines in the absolute amount (in constant dollar terms) received by California started to become apparent after 1985. Extended time-series data on prime contract awards for Los Angeles County are hard to come by, but the Department of Defense has made available some unpublished information for the last few years. In 1987, Los Angeles County absorbed \$10.0 billion in defense prime contract awards; in 1988 the figure was \$9.8 billion; and in 1989 it was \$9.0 billion. These figures represent from 38.9% to 41.9% of the California total.

The twenty-five major defense contractors in Los Angeles County are given in Table 5, together with their total prime contract awards in 1989. These twenty-five contractors collectively account for \$7.8 billion in defense prime contract awards, or 86.7% of the Los Angeles total.

Another major federal agency whose contracting activities have significant impacts on high technology industrial employment in Los Angeles is the National Aeronautics and Space Administration (NASA). Prime contract awards made by NASA to both the US as a whole and the State of California are shown in Table 6. The amounts involved are, of course, much smaller than in the case of defense prime contracts, but the State of California takes a very high (though declining) percentage of the total, and we may be sure that, once again, Los Angeles County is a dominant recipient of funds within the State.

High technology industrial development in Los Angeles County and its relationship to defense spending

The federal expenditures described above have been the primary source of the long-term growth of the core high technology industrial complex of Los Angeles. Overall employment trends in the complex since 1972 are depicted in Figure 1. The figure shows that high technology industry in Los Angeles County has grown fairly consistently over the last two decades, apart from a series of cyclical downturns. Since 1987, a sharp decline in high technology industrial employment is observable. In 1990, the complex employed 261,100 workers, a decline of 20,000 workers (i.e. 7.1%) since 1988. From the peak level of employment of 295,600 in 1987, the decline is 34,600 workers (i.e. 11.7%) - though recall that data for the post-1987 period is not strictly comparable to data for 1987 and before.

The trend for 1987 - 1990 shows a similar pace of decline to the trend indicated in the recent McKinsey report covering the entire State.[5] For aerospace-defense employment in the State of California as a whole, the McKinsey report shows the decline from 1987 to 1990 to be 10.2%. Data recently released by the Employment Development Department indicate that from the end of 1990 to October 1991, employment in the core complex had fallen a further 33,300 - a decline of 12.8% over just ten months, and there are strong signs that this process of decline is continuing.

In 1990, the core high technology complex accounted directly for 30.2% of manufacturing employment, and 6.0% of all employment in the County. In functional terms, the complex is actually larger than this, for it has many ramifications into the rest of the County's economy (see next section). In addition, it spills over geographically into the adjacent counties of Orange, Riverside, San Bernardino, and Ventura. Los Angeles County, however, still accounts for 70.2% of the high technology industrial employment in this wider five-County area (though the percentage is declining steadily over time as the more peripheral producing areas expand in size).

REGRESSION ANALYSIS OF DEFENSE PRIME CONTRACT AWARDS AND EMPLOYMENT IN HIGH TECHNOLOGY INDUSTRIES

Let us define X_t as defense prime contract awards to the State of California in year t in constant 1987 dollars; and let E_t be employment in the core high technology industrial complex of Los Angeles County in year t. For the period 1972 - 1987, these two variables are related to one another via the non-linear regression equation:

$$E_t = 1577.8X_t^{0.508}$$

with $R^2 = 0.71$ and degrees of freedom equal to 14. The t-statistic for the regression coefficient is 5.9 which is extremely significant. Because of the absence of extended time-series data on prime contract awards for Los Angeles County, data for the entire State are used instead; but since Los Angeles County takes a major share of the State's awards, this proxy measure is presumably roughly satisfactory. The equation indicates that the course of high technology industrial employment in Los Angeles follows very closely the course of defense prime contract awards.

Let us now attempt to extend the equation somewhat by incorporating data for the years 1988 and 1989 (i.e. subsequent to the 1987 changes in the Standard Industrial Classification). For the more extended time series, the regression equation is:

$$E_t = 1506.8X_t^{0.513}$$

with $R^2 = 0.71$ and 16 degrees of freedom. The t-statistic for the regression coefficient is 6.3. The two equations are markedly similar to one another, which raises confidence - despite the break in the high technology employment time series after 1987 - that the second equation is reasonably accurate.

A third equation was now computed for the period 1972 - 1989 with a one year time lag between E and X, i.e.

$$E_{t+1} = 1766.5X_t^{0.497}$$

with $R^2 = 0.76$ and degrees of freedom equal to 17. This time, the t-statistic for the regression equation is 7.2. The graph of the equation together with associated data points is given in Figure 2. Since this third equation is clearly preferable to the other two on statistical grounds, and since it is also conceptually convincing (i.e. the employment effects of any defense cutback are most prominent in the year succeeding the cutback) we shall use it our further explorations. Note, however, that a Durbin-Watson test reveals a statistically significant degree of temporal autocorrelation in this equation (as in the previous two). This means that the significance tests associated with these equations possess some intrinsic level of unreliability.

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[5]McKinsey and Company California's Aerospace-Defense Industry at a Turning Point, a report to the Los Angeles Area Chamber of Commerce, 1990.

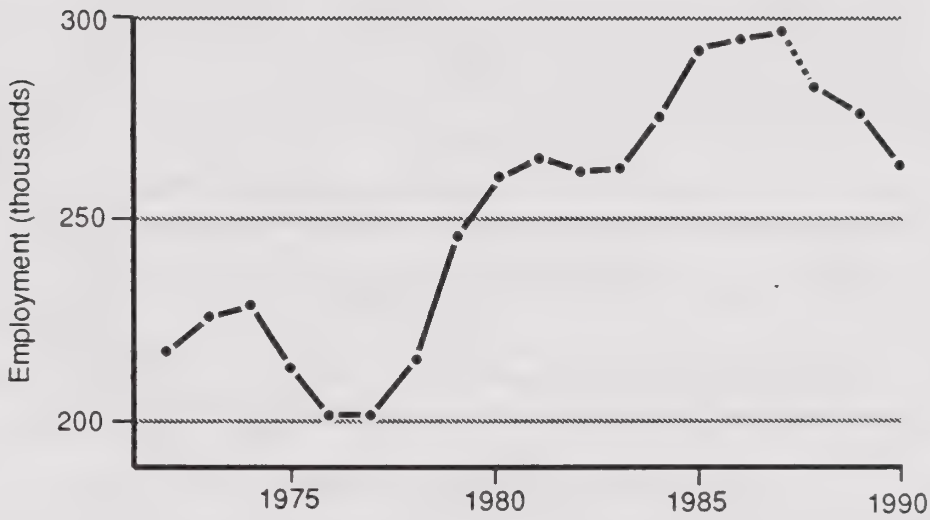

Figure 1. Employment in the core high technology complex of Los Angeles County, 1972-1990. Note change of definition of SIC categories after 1987.

The question that we now face is this: what degree of long-term correlation (if any) exists between Department of Defense spending as revealed in Table 4 and employment in the high technology industries of Los Angeles as identified in Table 3? We can use the regression analysis shown previously to make a few tentative inferences about the local employment effects of possible downturns in defense prime contracting activity. By establishing a benchmark level of defense prime contract awards in the State of California of $28,000 million (close to the peak value), we can use the time-lagged equation to simulate the effects of various hypothesized cuts in spending from this level. The results of this exercise are displayed in Table 7. Thus a 5% reduction would result in a fall of 2.52% in high technology jobs, and a 10% reduction would result in a fall of 5.10%.

A conservative estimate is that defense spending as a whole might decline by as much as 30% by the mid-1990s, though there is also evidence that the decline could be more than twice as great (see chapter 2). If the decline were 30%, high technology industrial jobs in Los Angeles County would fall by 16.24%, (or in absolute terms by 46,564 jobs) from the benchmark level; if the decline were 75% high technology jobs in the County would fall by 49.79% (i.e. 142,727 jobs). By this reckoning, a given percentage fall in defense spending will result in a reduction of high technology industrial employment in the County equivalent to approximately half to two-thirds of that percentage. More specifically the elasticity of the relation between E_t and X_t is 0.497, which indicates a positive but moderate responsiveness of the former to changes in the latter. These results are very consistent with the estimate presented above to the effect that between 51.2% and 65.1% of high technology industrial sales from Los Angeles County are made to the Department of Defense.

The level of dependence of high technology industry upon defense procurements as revealed by this analysis is somewhat more subdued than may perhaps at first have been thought to be the case, but it is highly significant even so. Moreover, the computed relationship between employment and defense spending does not take explicitly into account additional negative factors due to the economic cycle and on-going restructuring processes. Nor do the calculations take into account ripple effects from the high technology core to other sectors of the local economy, and it is to this issue that we now turn.

Impacts of defense spending on the wider economic system of Los Angeles County

Because of the direct, indirect, and induced effects of the core high technology industrial complex on other sectors in the County, the total impacts of defense spending extend far beyond the immediate confines of the core complex. In other words, core producers are linked upstream into a many-tiered input-output structure of subcontractors and service providers, and the wages of their workers support a large number of other local industries and trades. In the absence of a reliable large-scale and up-to-date input-output model of the County's economy, it is difficult to assess with any degree of precision what these impacts might be. Many authorities use the rule of thumb (based on Department of Defense calculations) that each defense job generates (via a multiplier effect) 1.5 other jobs

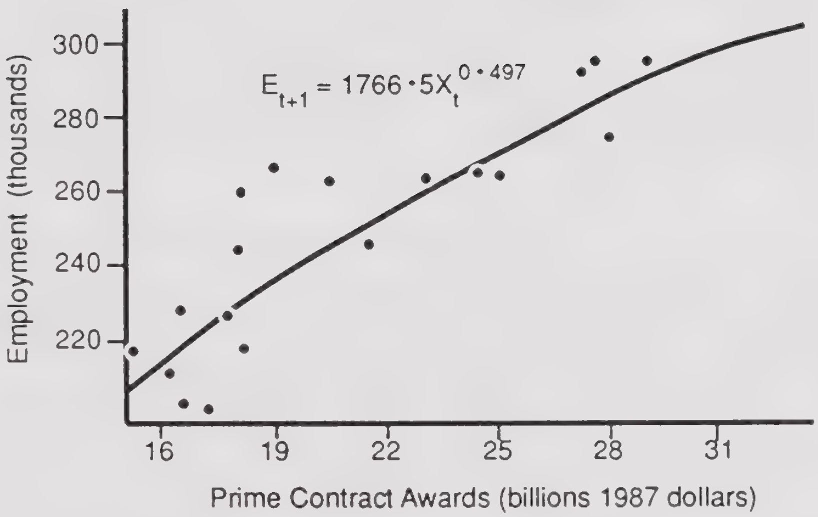

Figure 2. Lagged relationship between high technology employment in Los Angeles County and defense prime contract awards in the state of California.

in the local community.[6] This multiplier effect is almost certainly on the low side, and many would claim that it could be as high as 2.5 or 3.

CALCULATION OF TOTAL DEFENSE-RELATED EMPLOYMENT IN LOS ANGELES COUNTY

If we define the multiplier as β, we can compute an estimate of total defense-related employment (D) in Los Angeles County as:

$$D = \alpha E + \beta\alpha E = (1+\beta)\alpha E,$$

where E is (as before) employment in the core high-technology industrial complex, and α is the proportion of E that is directly supported by defense dollars. If α is estimated at 0.512 and β at 1.5, total direct and indirect defense-related jobs in the County in 1990 can be calculated as $D = 2.5 \times 0.512 \times 261{,}000 = 334{,}080$. This latter figure represents 7.8% of all employment in the County. This, however, is an extremely cautious estimate. If we set α equal to 0.651 and β equal to 2.5 (see earlier discussion) the total of direct and indirect defense-related jobs comes to 594,689, which represents 13.9% of the County's total employment.

Specific Sectoral and Local Effects of Defense Spending in Los Angeles County

The discussion thus far has emphasized the generalized impacts of defense spending on the County's economy. Some particular sectors and a number of individual municipalities in the County are likely to fare much worse than others as a result of actual and projected defense spending cutbacks.

Two sectors in particular would seem to be under threat, i.e. SIC 372 (aircraft and parts) and SIC 376 (guided missiles, space vehicles and parts), for a very high proportion of their output is purchased by the Department of Defense. According to calculations on national data, 44.2% of the output of SIC 372, and 90.1% of the output of SIC 376 is devoted to defense purposes[7]. The figures, again, are probably higher for Los Angeles. It should be noted that communication, search, and navigation equipment manufacturing is also at risk in the current climate of defense cutbacks, but the drastic changes in the definitions of these industries after 1987 make it extremely difficult to study long-run trends. That said, SIC 381 (navigation and search equipment) in Los Angeles lost a total of 13,200 workers between 1988 and 1990, i.e. a net decline of 17.2% over the two-year period. The various other electronics and instruments industries of the County are, to be sure, also greatly dependent upon defense contracting, but given their enormous diversity and flexibility, and the much greater likelihood that they can redeploy surplus capacity and labor to civilian uses, they would seem to be rather less vulnerable over the long run.

Aircraft, missile, and space equipment industries

These industries are comprised of SIC 372 (aircraft and parts) and SIC 376 (guided missiles, space vehicles and parts). The 1987 Standard Industrial Classification left the official definition of SIC 376 unchanged, while only minimal changes were made in SIC 372, so that in both cases, comparability of pre- and post-1987 data is feasible. In 1990, SIC 372 employed a total of 124,900 workers in Los Angeles County, and SIC 376 employed 15,400. There is thus a marked difference in the size of the two sectors. Figure 3 shows total annual employment in SICs 372 and 376 in Los Angeles County from 1972 to 1989.

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[6]See, for example, McKinsey and Company, Op. cit..

[7]Office of Policy Analysis, Op. Cit.

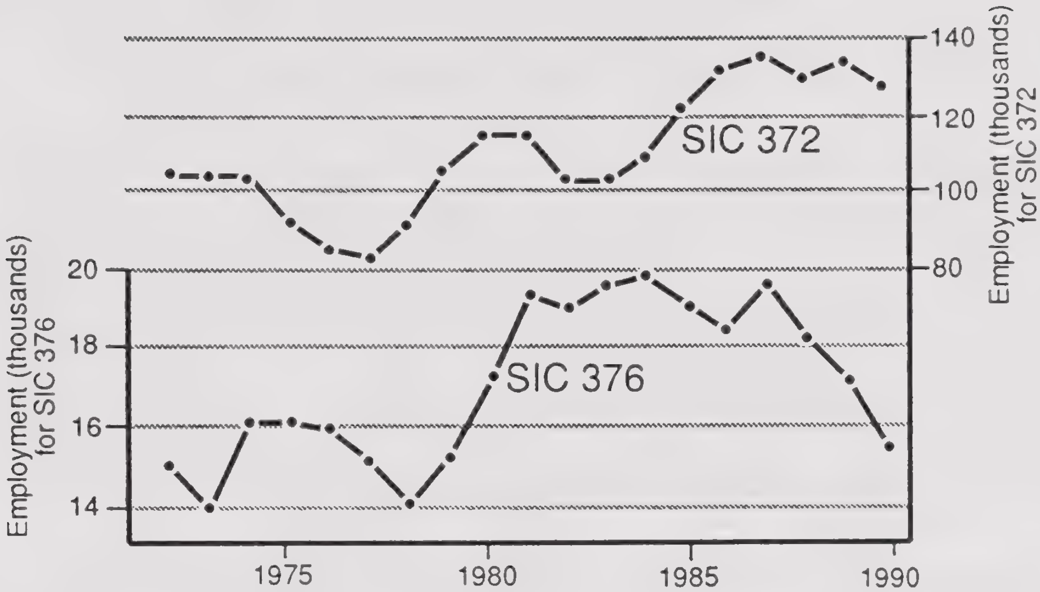

Figure 3. Employment in SIC 372 and SIC 376, Los Angeles County, 1972-1990. Source of data: State of California, Employment Development Department, *Annual Planning Information, Los Angeles County.*

The graphs of employment for the two sectors trend generally, if erratically, upwards over much of the 1970s and over the first half of the 1980s. In very recent years, however, the trend has been downwards, in conformity with the overall pattern of defense spending. Nevertheless, there are some marked contrasts between the two sectors in this regard. The aircraft and parts industry declined absolutely by 2.3% between 1987 and 1990, whereas the missile, space equipment and parts industry declined by 21.8%. In the former case, 2,900 jobs net were lost over this three-year period, and in the latter case 4,300 jobs were lost. (Over the first ten months of 1991 the aircraft and parts industry lost a further 10,400 jobs and the missile, space equipment and parts industry lost 2,400).

Relative to the United States as a whole, Los Angeles County is now steadily losing ground in both SIC 372 and SIC 376. This judgment is supported by the evidence laid out in Figure 4, which shows that Los Angeles' share of total US employment in SIC 372 was fairly stable, or even increasing slightly between the mid-1970s and mid-1980s, but that since 1985, there has been a slow, steady erosion of its share; SIC 376 has been in a more dramatic pattern of long-term relative decline since the mid-1970s. These relative declines seem to be a function of the deteriorating position of Los Angeles as a location for final assembly activities, combined with the accelerated development of space program production facilities and proving grounds in other parts of the Sunbelt, and in particular, in Alabama, Arizona, Colorado, Florida, and Utah.

These trends suggest that the aerospace industry of Los Angeles is now in the throes of a significant restructuring process. An expression of this process is the epidemic of lay offs and plant closings in the recent past, as in the cases of General Dynamics, Northrop, Lockheed, and McDonnell Douglas, and more of the same is promised in the future. In particular, the recent net loss of 5,000 jobs at Lockheed's Burbank plant as a result of relocation to Georgia is a severe blow to the region's economy. It is at this stage difficult to sort out within these trends what is due to recessionary conditions in the economy at large, what is due to defense cutbacks, and what is due to an overall process of relocation and the rationalization of capacity utilization. The coming defense cuts, however, will certainly make yet further inroads into the region's aerospace industry (as they have and will into the aerospace industry throughout the United States). It is possible, of course, that an increase in NASA spending in the future may help to offset some of the anticipated declines; however, since NASA prime contracts in California amount to just over 11% of Department of Defense prime contract awards, NASA cannot be expected fully to take up the slack. The problem will in all probability be exacerbated by the fact that the aerospace industries of Japan and Western Europe are becoming increasingly aggressive on world markets. Indeed Japan has targeted aerospace as one of its critical sectors for the 1990s, and a rising tide of competition from both east and west is to be expected.

Local labor markets and communities

One of the peculiarities of high technology industry in Southern California is that it is highly localized in a number of discrete industrial districts. These districts form in large degree as a result of the potent agglomeration economies that flow from the transactions-intensive interactions between individual establishments, and from the formation of large

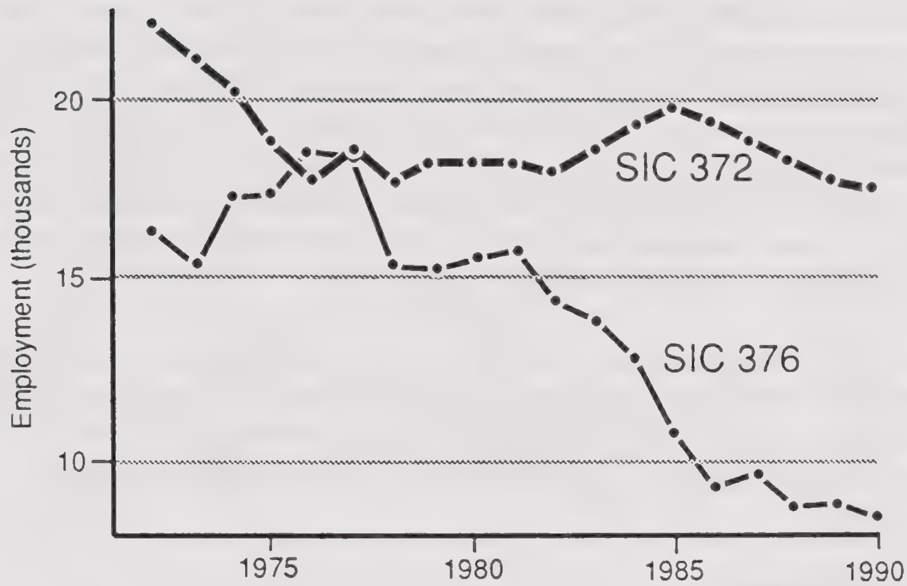

Figure 4. Employment in SIC 372 and SIC 376, Los Angeles County as a percent of the U.S., 1972-1990. Sources of data: State of California, Employment Development Department, *Annual Planning Information, Los Angeles County*; U.S. Department of Labor, Bureau of Labor Statistics, *Employment, Hours, and Earnings, United States, 1909-1990*, Bulletin 2370.

localized pools of labor serving these establishments.[8]

Figures 5 and 6 show the locations of manufacturing establishments in the aircraft and parts industry and in the electronics industry, respectively, in Southern California in 1988. In Los Angeles County, the two dominant concentrations of these industries occur in the western San Fernando Valley and in the Inglewood-Hawthorne-El Segundo area. These particular communities (along with the Palmdale area) have a relatively greater dependence on the aerospace-defense industry than almost any other part of the County. Furthermore this dependence is accentuated by the peculiar tendency for local labor markets to be spatially focused on work-place locations. This tendency is revealed dramatically by Figures 7, 8 and 9 which display the residential locations of workers employed by Rockwell North American, Lockheed, and McDonnell Douglas. The correspondence between places of work and places of residence is striking in all three cases. Calculations on the data on which these three figures are based indicate that typically over 60% of the labor force of any given plant lives within a radius of 15 miles from the plant.

This suggests that both industrial communities and residential communities in the San Fernando Valley and in the South Bay area are susceptible to particular difficulties in the event of continued major cuts in federal defense spending. Indeed, a recent research report has pinpointed precisely these two areas as being under particular threat.[9]

A Preliminary Diagnosis

The calculations and arguments laid out above provide us with a preliminary sense of the shape and form of the problem at hand. A large number of jobs is at stake in the defense-related segment of the economy of Los Angeles economy. Significant declines in employment are observable as a result of recent defense spending cuts, and further shrinkage is to be expected over the next several years. Moreover, in selected areas of Los Angeles County where there are dense nucleations of defense-oriented industries, the localized impacts of any defense cuts are likely to be felt with particular severity. Fortunately, the County's job base is extremely diverse, and while the aerospace-defense industries represent in absolute terms a significant number of jobs, in relative terms it is a reasonably limited and indeed declining proportion of the total job base. This circumstance suggests that remedial measures to reduce the negative impacts of defense cutbacks may be possible given carefully conceived and implemented policies for local economic development and industrial growth. We can be sure, however, that over the near term, grave problems lie ahead.

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[8]Cf. A. J. Scott, Metropolis: From the Division of Labor to Urban Form, Berkeley and Los Angeles: University of California Press.

[9]R. Law, J. R. Wolch, and L. Takahashi, The Future of Technopolis: Militarized Industrial Spaces in Southern California, unpublished paper, Department of Geography, University of Southern California, Los Angeles.

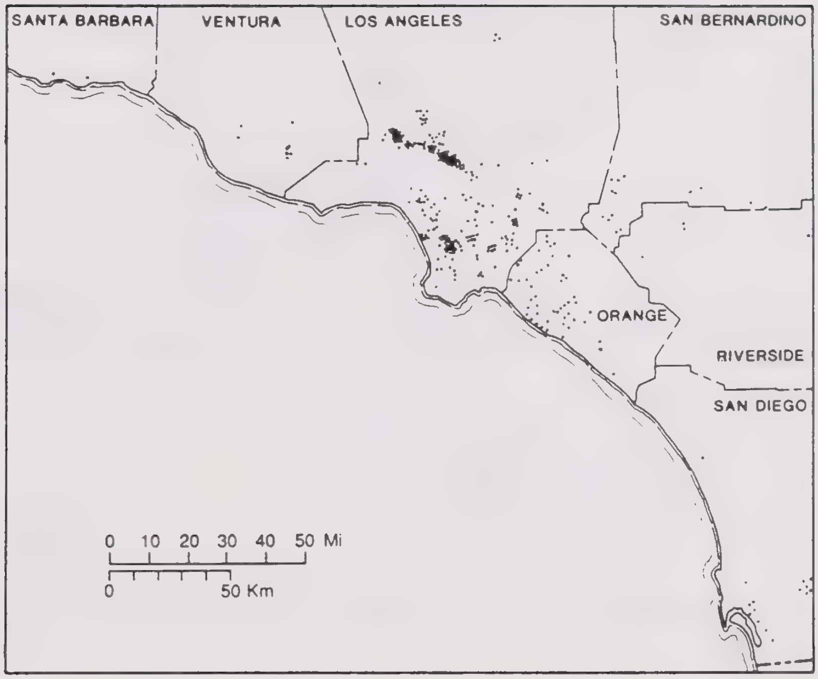

Figure 5. The aircraft and parts industry (SIC 372) in Southern California, 1988. One dot equals one manufacturing establishment.

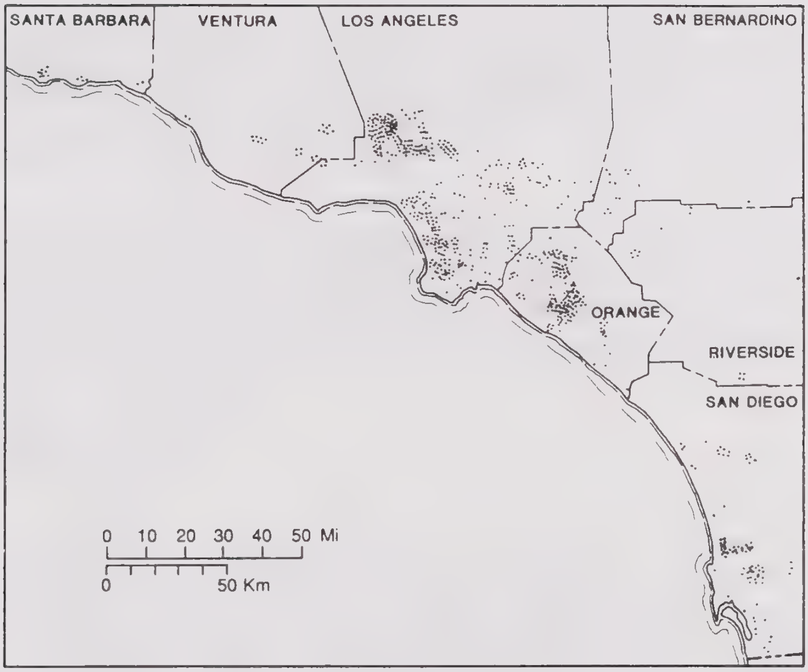

Figure 6. The electronics industry (SICs 357,366, and 367) in Southern California, 1988. One dot equals one manufacturing establishment.

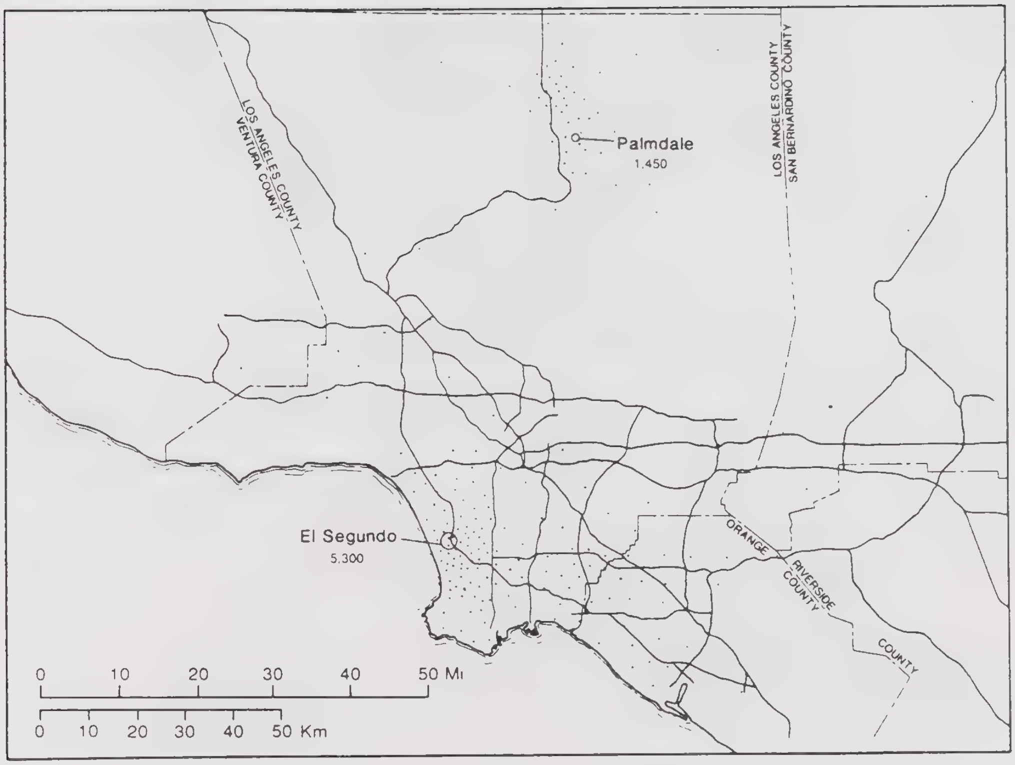

Figure 7. Residences of workers employed by Rockwell North American plants at El Segundo and Palmdale. Major Freeways are shown. Each dot represents 30 workers.

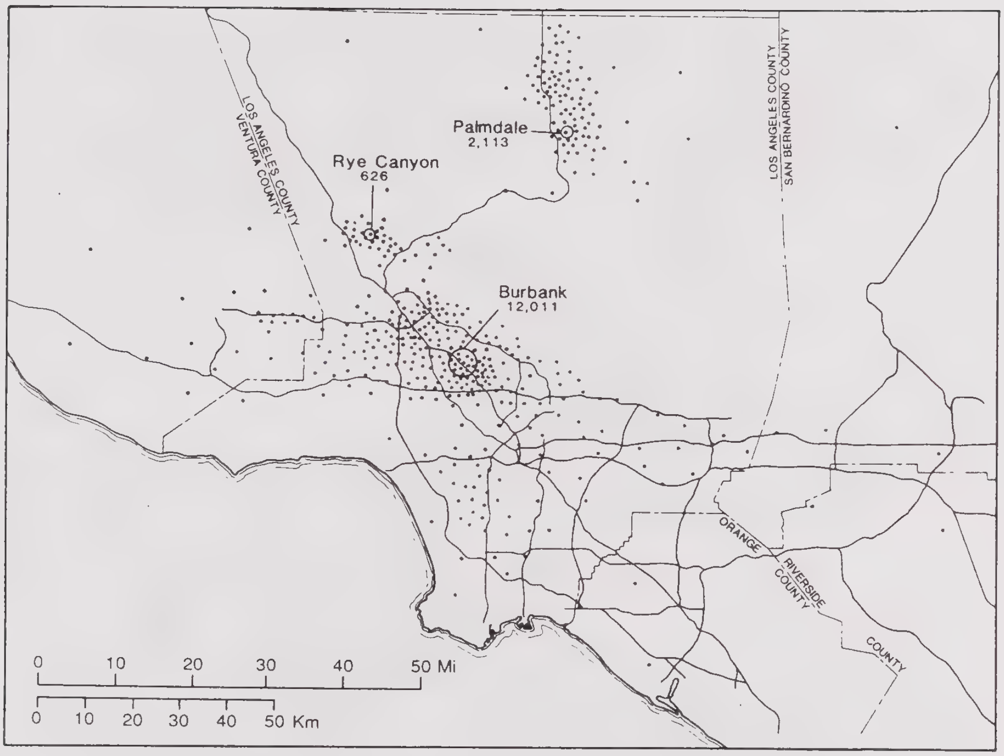

Figure 8. Residences of workers employed by Lockheed plants at Burbank, Palmdale, and Rye Canyon. Major freeways are shown. Each dot represents 30 workers.

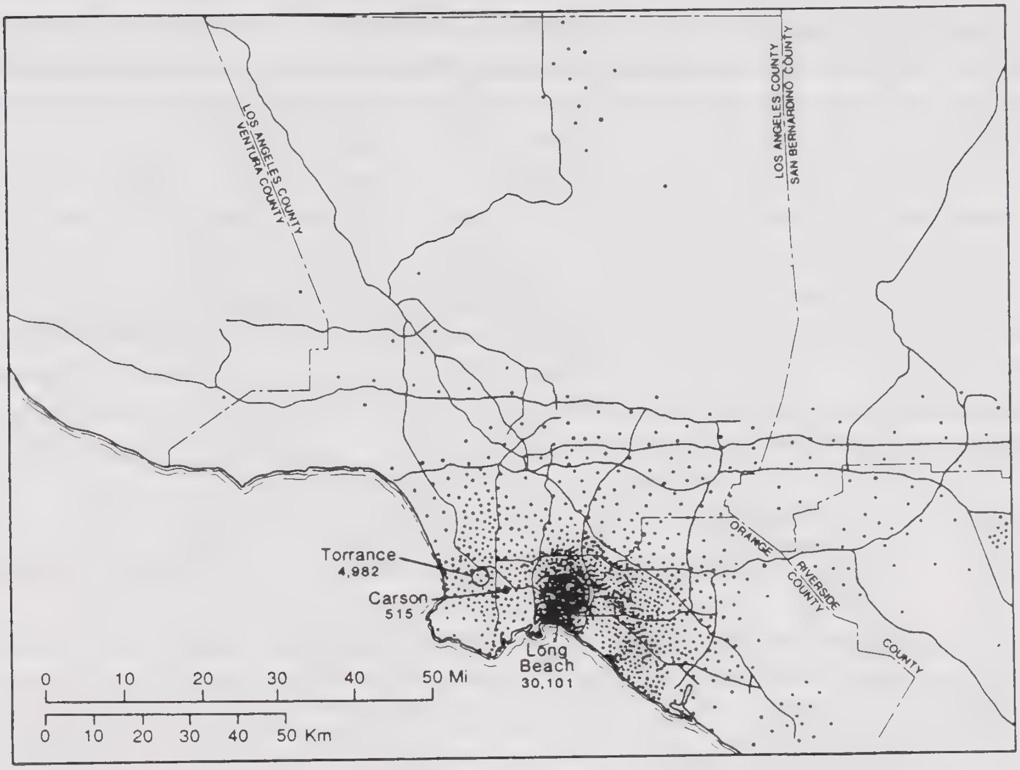

Figure 9. Residences of workers employed by McDonnell-Douglas plants at Long Beach, Carson and Torrance. Majors freeways are shown. Each dot represents 30 workers.

INTER-INDUSTRIAL LINKAGES AND LOCATION

One of the major difficulties that we encounter in any attempt to assess the magnitudes and directions of change in large industrial complexes (such as the defense- and space-oriented industries of Los Angeles County) is that these systems exert and are subject to many direct and indirect multiplier effects. This problem was raised earlier in this chapter, where it was proposed that for every job lost (or gained) in the region's aerospace-defense industries, 1.5 to 2.5 jobs are lost (or gained) in other sectors of the local economy.

The detailed structure of all such problems as these is summarized in Figure 10 for a production complex that is assumed for simplicity of graphic depiction to consist of three sectors. Here, it is taken that there has been some change - positive or negative - in the

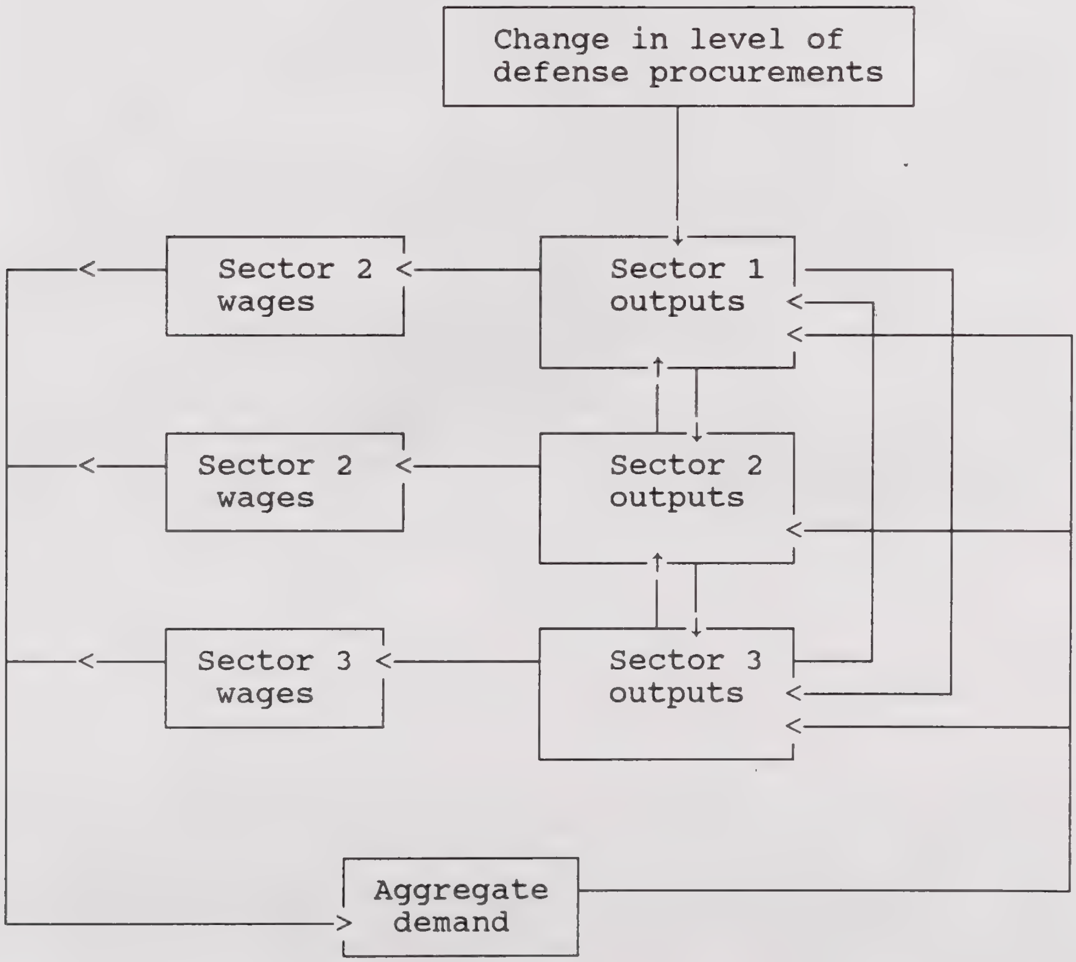

Figure 10. Industrial complex analysis: Direct and indirect input-output relations, plus induced effects via workers' expenditures.

overall level of defense procurements. This change has an immediate impact on sector 1 (say, the aerospace industry), and then a series of first-round impacts on sectors 2 and 3 which are presumed to supply sector 1 with inputs. However, these first-round impacts reverberate through the system in a succession of second-, third-, fourth-, fifth-, ..., etc., impacts on sectors 1, 2 and 3. At the same time, these impacts have an effect on wages and employment levels, which in turn affect sectors 1, 2, and 3 via changes in workers' levels of consumption.

Obviously, the complexity of all these interrelationships is enormous, especially where - as in the case of Los Angeles - the number of sectors involved is in the hundreds, if not thousands. In the end, a satisfactory accounting of all of the many ramifications of the presumed initial change in the level of defense procurements can only be effectively examined if we have both a detailed and up-to-date input-output model of the regional economy together with a multi-equation econometric model of demand behavior. However, the complexities do not end even here, for if we are dealing with a regional economy then we must also take account of all direct and indirect flows into and out of the region. There is no reliable model or simulation system of the Los Angeles economy currently available which can effectively deal with all of these tasks and provide numerical evaluations for policy-making purposes. Accordingly, at this stage, it is necessary for us to approach the problem of defense- and space-related inter-industrial linkages within and around the region's high-technology complex with the aid of heuristic and descriptive methods.

The main questions that we are interested in here are the following:

- What are the likely impacts of a decline in prime contract awards to Los Angeles aerospace producers on secondary tiers of manufacturers and service suppliers in the region?

- What are the likely impacts of a decline in prime contract awards in the rest of the United States on the Los Angeles economy?

- What are the likely implications of these impacts on the location of industry in Los Angeles County relative to the United States as whole?

Attempts to provide some tentative answers to these questions will now be offered on the basis of (a) detailed questionnaire survey data and (b) unpublished data provided by NASA on first- and second-tier subcontracting patterns across the whole of the United States.

Linkage Patterns of Defense Contractors in Los Angeles County

The analyses in this section are based upon a mail questionnaire survey of defense contractors in Los Angeles County (see chapter 1 for details of this survey). Some 400 questionnaires were sent out in the Fall of 1991, and 104 of these were returned.

A brief statistical profile of questionnaire respondents

Of the 104 establishments that returned a questionnaire, 84 are involved in manufacturing activities, and 20 are in a variety of service sectors (see Table 8). The majority of respondents are in a core cluster of high-technology and related sectors focused on computers, electronics, transportation equipment (i.e. aircraft, missiles, space vehicles, and parts), and instruments. The average size of these establishments is 1,216 employees, and the median size is 82, the great difference between the two values being accounted for by the fact that there is one extremely large aircraft producer in the sample, and this producer moreover combined data for two establishments when answering the questionnaire. Table 9 shows the frequency distribution of establishment sizes, and it is evident that most respondents are in the small- to medium-sized categories, which parallels the industrial structure of Los Angeles County as a whole.

For our 104 sample establishments, 54.4% of sales on a simple average basis go to the Department of Defense, and 65.1% on a weighted average basis. As we might expect, the proportion of defense sales tends to increase as the size of establishment increases (see Table 10). This is consistent with a view of the local high-technology industrial complex as a many-tiered structure of manufacturing establishments with large defense-oriented systems houses at the top, and small suppliers and subcontractors at the bottom. The same notion is echoed in the data presented in Table 11 where we see that as size of establishment increases, the percentage of total sales made up by off-the-shelf products decreases markedly. By contrast, larger establishments are much more given to the production of customized products, presumably for various federal defense and space agencies. Observe in Table 11 that both large and small establishments do significant amounts of subcontracting, which is consistent with the nature of defense-oriented industrial complexes where much highly-specialized task activity occurs.

Linkage structures of questionnaire respondents

One of the objectives of the questionnaire survey was to determine the extent to which defense contractors in Los Angeles are tied through their input-output linkages to the local economy. Current theoretical work on this question suggests that there is likely to be a dense network of localized linkages focused on major producers. However, the same work also suggests that larger producers will be characterized by a mix of local and non-local linkages, whereas smaller producers and subcontractors will tend to be dominantly and sometimes even exclusively linked to the local economy.[10] The reasoning underlying this expectation is derived from the idea that there are usually strong economies of scale associated with large firms' capabilities in the management of both simple flows of goods and services as well as more complex forms of information exchange and actual movements of personnel. Accordingly, large establishments with large-scale linkages will be able more effectively to transact business over long distances than small establishments with small-scale linkages. Moreover, smaller producers are also typically more transactions-intensive

[10] See in particular: A. J. Scott, New Industrial Spaces: Flexible Production Organization and Regional Development in North America and Western Europe, London: Pion Ltd., 1988; and M. Storper and R. Walker, The Capitalist Imperative, Oxford: Blackwell, 1989.

than larger producers in the sense that proportionately more of their overall effort is invested in tasks of securing inputs and disposing of outputs.

A first confirmation of this view of things is provided in Table 12 which shows that for surveyed establishments, the number of customers dealt with as a ratio of total employment declines markedly with increasing employment. A second confirmation comes from the data displayed in Tables 13 and 14. Here, we see that sample establishments are much more integrated into the local economy if they are small in size, whereas larger establishments are more strongly connected to customers and suppliers in the rest of the US and in the rest of the world. As we might expect, suppliers are in all cases much more concentrated in Southern California than are customers, which is presumably a reflection of the circumstance that we are dealing in this sample specifically with defense-oriented producers who sell their output pre-eminently to federal defense and space agencies. Fully 60.0% of the suppliers of small establishments (i.e. with employment of 99 or fewer workers) are located in Los Angeles County.

Let us now consider the locations of the customers and suppliers of sample establishments as a function of the dependence of the latter on defense markets. Unsurprisingly, as Table 15 tells us, establishments that are highly dependent on the Department of Defense for their final sales tend to have customers that are dominantly outside of Southern California. Exactly the reverse is the case, however, for their suppliers, and this is just as we might expect given the transactions-intensive nature of defense-oriented manufacturing. The data presented in Table 16 suggest that the more establishments sell (proportionately) to the Department of Defense, the more they tend to buy their inputs from the local area. Indeed, a majority of the suppliers of surveyed establishments with high levels of defense sales are located in Los Angeles County itself.

These findings indicate that the defense-oriented industrial complex of Los Angeles County consists of a strongly-stratified and multifaceted ensemble of producers all of whom have tight linkages to one another, but in which (a) small establishments are more insistently tied to the local economy than large, and (b) establishments which sell a large proportion of their final output to the Department of Defense tend to secure their inputs predominantly from the local area. These relationships seem clear enough from the data presented, but they still do not provide the precise quantitative assessment of the functional and spatial structure of inter-industrial linkages that an input-output model would give us. Fortunately, we have been able to obtain detailed unpublished data from NASA that make it possible to pursue this question in somewhat more depth, though assuredly not with the ultimate degree of resolution of the problem that an input-output model would provide.

NASA Prime Contractors and Subcontractors: The Southern Californian Nexus

The data obtained from NASA enable us to map out for the whole country the locations of all prime contractors and the directions of all first- and second-tier subcontract flows in

1989.[11] The information is deficient in several important respects, but it also offers a unique and invaluable view of the structure of inter-industrial linkages in the aerospace industry in the US and Southern California. As we shall see, what emerges from an examination of these data is a clear affirmation of the dominance of Southern California within the US aerospace complex, though there is also a disturbing long-run decline in its relative national importance.

NASA prime contract awards: a brief overview

In 1989,[12] NASA awarded prime contracts valued in total at $9,026.1 million. By comparison, Department of Defense prime contracts in the same year totalled $128,958.0 million, i.e 14.3 times more than the equivalent NASA figure. Compared to the Department of Defense, then, NASA's budget is modest, though in absolute terms NASA must still be seen as a significant economic force. California is much the most important recipient of NASA prime contracts with 30.2% of the national total in 1989 (compared with 43.5% in 1980); it is followed by Florida with 13.7% and Texas with 12.2%.

We now consider how Los Angeles County is situated within the overall national system of NASA prime contract awards and subcontracting activity. We approach this task by moving steadily from a level of geographical resolution focused on census divisions and states, to a level focused on Los Angeles in the context of the other counties of Southern California.

Inter-regional subcontracting activities based on NASA prime contract awards

The NASA data on which this study is based contain information for 1989 on (a) prime contract awards by individual contractor, (b) all individual first-tier subcontracts valued at $10,000 or more, where the prime contract exceeds a value of $500,000, and (c) all individual second-tier subcontracts valued at $10,000 or more, where the first-tier subcontract exceeds a value of $50,000. These restrictions on what subcontracts are recorded by NASA mean that the data are seriously truncated in terms of the number of subcontracts reported, though they account for by far the greater proportion of the total in terms of dollar value. Because data are provided at the detailed level of the individual subcontract (together with the locations of the parties involved) exhaustive inter-regional linkage data can be assembled. The task of assembly, however, is extremely laborious, and given the size of the full data set (involving as it does several hundred pages of printout) a means of reducing the work involved had to be found.[13] Thus, we examine only those first- and second-tier subcontracting activities that derive from prime contracts whose first-tier subcontracts total $10 million or more. In 1989, there were 39 such prime contracts.

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[11]The data come in the form of a computer printout entitled NASA Subcontracts Awarded by NASA Major Prime Contractors and their First-tier Subcontractors, Washington, D.C.: NASA Office of Procurement, 1989.

[12]In this and all subsequent references to any year, t, for which NASA financial data are given, the strict sense of t is the NASA fiscal year which stretches from October in year t-1 to September in year t.

[13]The data set on which this study is based is available in hard copy only. Unfortunately, NASA will not or cannot make the data available on computer diskette.

They account for 64.7% of all NASA prime contract awards by value in the United States in that year. Information on these prime contracts is arrayed in Table 17. The 39 individual contracts are allocated to 28 different establishments, and 12 of them (representing 48.7% of their overall value) are assigned to establishments in Southern California - all of them with one exception located in Los Angeles County. These establishments belong to the California Institute of Technology[14], McDonnell-Douglas Corp., Rockwell International Corp., and TRW Inc.

In aggregate, $2,732.8 million (i.e. 46.8%) is subcontracted out from the 39 prime contracts in the form of 10,406 individual first-tier subcontracts. As shown in Table 17, there are a few cases where the total sum of money subcontracted out in the first tier is actually greater than the prime contract amount; this is because of the carrying forward by some subcontractors of moneys awarded in previous years.

Information on the origins and destinations of these first-tier subcontracts by major geographic division of the United States is presented in Tables 18 and 19. The degree of subcontracting activity concentrated on the Pacific region is especially noteworthy; this accounts for fully 56.8% by value of all first-tier subcontracts issued, and 33.9% of all first-tier subcontracts received. Most of this activity is focused on California, and more specifically, on Southern California.

The flow of second-tier subcontract funds between major geographic divisions of the United States is shown in Tables 20 and 21. Linkages to and from the Pacific division still dominate the second-tier system. More significantly, there is now a large net inflow of subcontracts into the Pacific division from the rest of the country, and these seem to be largely directed to Southern California's many specialized aerospace and electronics component manufacturers. The total dollar amount of second-tier subcontracting activity reported in Table 20 is $85.0 million, just 3.1% of total first-tier activity, though it must be recalled that the problem of truncated statistical reporting is especially severe at the second-tier subcontracting level.

The Southern California aerospace nexus

Southern California is here defined as the seven counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, and Ventura. This region accounts for 23.3% by value and 30.8% by number of contracts of all first-tier subcontracting work done in the United States.

First-tier subcontracting relations between Southern California and the rest of the United States are summarized in Tables 22 and 23. The set of Southern Californian prime contractors under examination here subcontracted out a total of $1,514.0 million in 1989, of which 38.5% remained within the region, and 61.5% was assigned to the rest of the

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[14]The California Institute of Technology is not, of course, a manufacturing firm like the other prime contractors mentioned here. It is in fact the equivalent of a NASA field office. However, NASA officially designates contracts given out by the Institute as subcontracts rather than prime contracts.

country. By contrast, only 4.3% of the $1,218.8 million subcontracted out by primes elsewhere in the United States was assigned to Southern California. To some degree this discrepancy may be ascribed to the peculiarities of the data used here. In brief, the frequency distribution of subcontracts by dollar amount is highly skewed by a few disproportionately large values, and a single sizable outlier can distort results very considerably. For example, in 1989 Boeing at the Marshall Space Flight Center in Alabama placed one subcontract order with Lockheed Missile and Space Systems in Sunnyvale in (northern) California valued at $158.2 million, or 5.9% of all the first-tier subcontract awards indicated in Table 17.

If we look at Southern California's role in the national subcontracting system in terms of number of contracts, its position appears to be somewhat improved. Fully 56.7% of the number of subcontracts given out by Southern California primes remain in the region, and 9.4% of subcontracts originating elsewhere in the country are directed to Southern California.

These observations confirm that while prime contractors evince a clear need to go outside of their local area for a large part of their first-tier subcontract needs, there is considerable intra-regional subcontracting, especially in Southern California. The data presented in Tables 18 and 19 also indicate that extra-regional (non-local) linkages involve fewer and larger individual contracts than intra-regional (local) linkages. Thus, extra-regional subcontracts average $336.1 thousand each, and intra-regional subcontracts average $205.7 thousand each.

At the level of second-tier subcontracting, Southern California again emerges as a major node of activity, with a disproportionately large flow of orders entering the region from the rest of the United States (Tables 24 and 25). This feature to some degree offsets the major leakages from the region observable at the first-tier level. In addition, by far the greater proportion of second-tier subcontracts given out by first-tier subcontractors in Southern California remain within the region. Once more, individual non-local linkages tend to be larger than local, with the former averaging $146.9 thousand per subcontract, and the latter averaging $81.1 thousand.

Within Southern California itself, Los Angeles County is absolutely dominant as a center of NASA prime contract and subcontract activity. This state of affairs is clearly brought out by the data set forth in Table 26, (in which subcontracts received are from all sources both inside and outside of Southern California). Despite a considerable locational decentralization of manufacturing business from Los Angeles to peripheral counties over the last few decades, the County retains its position as the unrivalled hub of major aerospace corporations and innumerable aerospace assembly plants and parts producers in the region. The only other County in Southern California that also plays a really significant role in the aerospace industry is Orange County, and this receives less than one-tenth of the prime contract awards that go to Los Angeles County. Even San Diego County with its long-standing aerospace industry (focused on General Dynamics Convair) is dwarfed by Los Angeles County.

Information about first-tier subcontracting by value between the counties of Southern California is provided in Table 27. Data on numbers of contracts are not presented here since they more or less duplicate the data in Table 27. The dominance of Los Angeles County within the local subcontracting system is highlighted once again by Table 27. There is, most notably, considerable intra-County subcontracting in Los Angeles (as well as in Orange County). Also, some leakage of subcontract orders from Los Angeles to the rest of the region is in evidence. For Los Angeles County, the ratio of total first-tier subcontract inflows to outflows by value is 0.81, and for the rest of the region the ratio is 3.36.

At the second-tier subcontract level, inter-County flows by value run parallel to the flows revealed in Table 27. Internal transactions within Los Angeles County account for 29.3% of all activity within the region. The ratio of total second-tier inflows to outflows for Los Angeles County is 0.93, and for the rest of the region it is 1.06, attesting again (though in a more subdued form) to the function of the central production system of Los Angeles in channelling money into the peripheral counties of the region.

Locational Trends

From all of the above, we learn that the economy of Southern California in general and of Los Angeles County in particular is highly vulnerable to downturns in DOD and NASA prime contracting activities. This is not simply because the region receives a large proportion of all prime contract awards, but also because - as we have seen - large numbers of other producers are dependent upon the direct and indirect subcontracts that flow from these awards. These other producers, moreover, are dependent not just on subcontracts from local primes, but also and to a significant degree from primes and subcontractors in the rest of the country. This means that the multiplier effects alluded to above are likely to operate with some force. The vulnerability of the County's aerospace-defense industries is underlined by data from our questionnaire survey which tell us that the more manufacturers are dependent on the Department of Defense for their final market, the less they anticipate that they will grow over the next five years and the more they anticipate that they will decline (see Table 28). These latter findings are statistically significant by a chi-squared test at the 0.01 level.

The single positive note in this analysis is that establishments with a high level of dependence on defense procurement are no more likely than establishments with a low dependence either (a) to have relocated some of their facilities over the period 1987 - 1991, or (b) to anticipate relocating over the period 1992 - 1996. By contrast, as indicated by Table 29, there is a very significant actual and anticipated propensity on the part of larger establishments to relocate at least some of their activities. Thus, while there has been much relocational activity in the past, - a tendency that is likely to continue - this particular phenomenon does not seem to be related to trends in defense and space spending.

What we can expect overall in the future with continued declines in DOD spending is a steady erosion of the industrial base of the region, as both prime contractors and their dependent direct and indirect suppliers cut back on their employment. Given the pressures that NASA is currently facing, it seems reasonable to expect that spending from this source may also decline in the future, or at best that it will grow very slowly indeed (as was the case over the 1980s). That said, a federal decision to upgrade the activities of NASA in partial substitution for DOD cutbacks would certainly have a major positive impact on employment growth in Los Angeles County even though it would be unlikely to compensate entirely for jobs lost in the defense-dependent sector.

RECOMMENDATIONS

This chapter has dealt mainly with empirical conditions and trends in the aerospace-defense industries of Los Angeles County. It is apparent that in the absence of concerted action on the part of state and local agencies, the problems of these industries are likely to go from bad to worse. On the basis of the above discussion, we can tentatively point to some possible lines of counter-attack on these problems, and in subsequent chapters of this report, these are explored in considerable detail.

1. Conversion strategies for the County's aerospace-defense industries need to be investigated. One possible strategy might involve attempts to establish the County as a major center of advanced research, development, and manufacturing for innovative ground transportation systems.

2. Los Angeles County should provide leadership for more concerted strategic targeting of promising new industrial opportunities (e.g. electric cars, medical instruments, biotechnology, artificial intelligence). Monitoring of industries that seem to be flagging in the competitive race is also important, and an early warning system of anticipated problems should be installed.

3. There is an urgent need for new institutions (e.g. private-public partnerships) for the creation and dissemination of innovative technologies.

4. Labor retraining schemes for displaced aerospace workers are essential. In addition, overall skills enhancement of the County's labor force is extremely desirable in the new international competition where product quality as much as cost is a critical variable.

5. Los Angeles County's economic development capability should be strengthened through a more proactive approach to planning for industry.

In addition, it is clear that the absence of an elaborate and up-to-date input-output accounting model for Los Angeles County puts serious limitations on the amount and the quality of policy-relevant economic development research that can be done. Funding is

urgently needed to correct this lacuna, and to provide for periodic up-dating of input-output information.

Table 1. Total employment, major sectors, Los Angeles County, 1972 - 1990.

Sector	Employment ('000) 1972	1989	Percent Change
Agriculture	8.0	12.8	60.0
Mining	10.7	8.4	-21.5
Construction	97.2	160.5	65.1
Manufacturing	774.5	858.9	10.9
Transportation and public utilities	171.4	221.6	29.3
Wholesale trade	195.5	313.8	60.5
Retail Trade	453.3	658.2	45.2
Finance, insurance, and real estate	177.9	292.5	64.4
Services	571.1	1245.7	118.1
Government	436.5	538.4	23.3
All industries	2896.1	4310.6	48.8

Source: Employment Development Department, State of California, Annual Planning Information, Los Angeles-Long Beach Metropolitan Statistical Area, (annual).

Table 2. Total Manufacturing Employment, 2-digit sectors, Los Angeles County, 1972 - 1987.

SIC	Employment ('000) 1972	1987	Percent Change
20. Food and kindred products	49.8	48.6	-2.4
22. Textile mill products	9.2	10.6	15.2
23. Apparel and other textile products	59.1	92.3	56.2
24. Lumber and wood products	11.2	12.7	13.4
25. Furniture and fixtures	29.2	38.7	32.5
26. Paper and allied products	16.4	18.7	14.0
27. Printing and publishing	41.1	59.8	45.5
28. Chemicals and allied products	27.1	28.2	4.1
29. Petroleum and coal products	13.6	10.6	-22.1
30. Rubber and miscellaneous plastics	28.9	33.1	14.5
31. Leather and leather products	5.6	5.2	-7.1
32. Stone, clay, and glass product	23.6	17.8	-24.6
33. Primary metal industries	24.9	20.8	-16.5
34. Fabricated metal products	69.2	68.0	-1.7
35. Machinery, except electrical	70.8	65.2	-7.9
36. Electric and electronic equipment	100.2	155.3	55.0
37. Transportation equipment	150.9	172.2	14.1
38. Instruments and related products	23.4	28.3	20.9
39. Miscellaneous manufacturing products	20.7	20.3	-1.9
All manufacturing	774.5	906.5	17.0

Source: Employment Development Department, State of California, Annual Planning Information, Los Angeles-Long Beach Metropolitan Statistical Area, (annual).

Table 3. The core high technology industrial complex of Los Angeles County in terms of the 1972 and 1987 standard industrial classifications.

1972 SIC code	1972 Description	1987 SIC code	1987 Description
357.	Office and computing machines	357.	Computer and office equipment
366.	Communication equipment	366.	Communications equipment
367.	Electronic components and accessories	367.	Electronic components and accessories
372.	Aircraft and parts	372.	Aircraft and parts
376.	Guided missiles, space vehicles and parts	376.	Guided missiles, space vehicles and parts
		381.	Search and navigation equipment
382.	Measuring and controlling devices	382.	Measuring and controlling devices

Source: Office of Management and Budget, Standard Industrial Classification Manual, 1972 and 1987.

Table 4. Department of Defense Prime Contract Awards, US and California, 1972 - 1989.

	Prime Contract Awards ($millions)		California as a percent of the US
	US	California	
1972	36283	6016	16.6
1973	34741	6215	17.9
1974	37760	6917	18.3
1975	43355	7908	18.2
1976	44679	8949	20.0
1977	52752	10078	19.1
1978	61174	10517	17.2
1979	65481	11675	17.8
1980	76430	13853	18.1
1981	96653	16630	17.2
1982	115280	22578	19.6
1983	118744	26387	22.2
1984	124015	28520	23.0
1985	140096	29115	20.8
1986	136026	27738	20.4
1987	156508	24515	15.7
1988	151352	23459	15.5
1989	139343	23125	16.6

Source: Department of Defense, Office of the Secretary, Prime Contract Awards by State.

Table 5. The twenty-five top defense prime contractors in Los Angeles County in 1989.

Name of contractor	Total awards ($M)
McDonnell Douglas Corp.	2184.1
Hughes Aircraft Co.	1058.4
TRW Inc.	836.9
Rockwell International Corp.	813.6
Lockheed Corp.	373.0
Aerospace Corp.	301.4
Aerojet Electro Systems	281.0
General Dynamics Corp.	274.6
Aerojet	249.6
Northrop Corp.	226.8
Chevron USA Inc.	220.9
Litton Systems Inc.	184.9
ITT Gilfillan	141.0
Navcom Defense Electronics	127.9
Allied Signal Aerospace Co.	98.7
Flying Tiger Line Inc.	66.4
Allied Signal Inc.	52.9
Rand Corp.	51.0
Sargent Fletcher Co.	42.0
Eaton Corp.	39.9
Teledyne Industries Inc.	39.7
Litton Industries Inc.	38.4
Simulaser Corp.	37.1
ITT Corp.	34.5
University of S. California	33.1

Source: unpublished data provided by the Department of Defense.

Table 6. NASA prime contract awards in the United States and California.

Year	USA ($M)	California ($M)	California as a percent of US
[1962-1978]	48464.3	19720.5	40.7
1979	3485.0	1439.0	41.3
1980	3958.2	1721.3	43.5
1981	4386.2	1875.4	42.3
1982	4900.1	2056.5	42.0
1983	5667.6	2131.2	37.6
1984	6119.9	2150.0	35.1
1985	6835.2	2236.5	32.7
1986	6568.0	2000.0	30.4
1987	6791.6	2224.9	32.7
1988	7577.2	2411.4	31.8
1989	9026.1	2727.7	30.2

Source: NASA, Procurement Report, (semi-annual).

Table 7. Computed effects of hypothesized cuts in defense prime contract awards in California on high technology employment in Los Angeles County.

Iteration	Hypothesized award level ($million)	Percent change in award level from iteration 0	Computed employment in core high technology complex	Change in employment from iteration 0	
				Absolute	Percent
0	28000	-	286649.4	-	-
1	27720	1	285221.2	1428.2	0.50
2	27440	2	283785.7	2863.8	1.00
3	27160	3	282342.8	4306.7	1.50
4	26880	4	280892.3	5757.1	2.01
5	26600	5	279434.3	7215.1	2.52
6	25200	10	272025.5	14623.9	5.10
7	23800	15	264406.6	22242.8	7.76
8	22400	20	256558.7	30090.7	10.50
9	19600	30	240084.9	46564.6	16.24
10	16800	40	222378.2	64271.2	22.42
11	14000	50	203113.7	83535.7	29.14
12	7000	75	143922.0	142727.4	49.79

Table 8. Sectoral distribution of questionnaire respondents.

SIC category	Number of establishments	Percent
28 Chemicals and allied products	5	4.8
29 Petroleum and coal products	2	1.9
30 Rubber and miscellaneous plastics products	2	1.9
33 Primary metal industries	2	1.9
34 Fabricated metal products	10	9.6
35 Industrial machinery and equipment	10	9.6
36 Electronic and other electronic equipment	16	12.5
37 Transportation equipment	29	27.9
38 Instruments and related products	11	10.6
50 Wholesale trade: durable goods	5	4.8
73 Business services	5	4.8
87 Engineering and management services	6	5.8
Total	104	

Table 9. Frequency distribution of questionnaire respondents by establishment size.

Employment size class	Frequency (number)	Frequency (percent)
0 - 19	17	16.35
20 - 49	20	19.23
50 - 99	18	17.31
100 - 249	16	15.38
250 - 499	10	9.62
500 - 999	11	10.58
1000 - 4999	6	5.77
5000+	6	5.77
Total	104	

Table 10. Questionnaire respondents: proportion of total sales made to the Department of Defense.

Size of establishment	Average percent of sales to DOD	Number of establishments
0 - 99	48.5	54
100 - 499	52.7	26
500+	72.7	22

Table 11. Questionnaire respondents: percentage of total sales made up by different forms of output.

Size of establishment	Percent of total sales			Number of establishments
	Off-the-shelf products	Work sub-contracted in	Custom products	
0 - 99	25.8	27.2	23.1	55
100 - 499	15.8	24.1	46.3	26
500+	12.3	31.9	49.4	23

Table 12. Number of customers by size of establishment for questionnaire respondents.

Size of establishment	Average number of customers per establishment	Customers per worker	Number of establishments
0 - 99	318.2	8.6	55
100 - 499	296.5	1.3	26
500+	316.0	0.1	23

Table 13. Geographic distribution of customers of questionnaire respondents by size of establishment.

Respondents: size of establishment	Percent of customers				Number of establishments
	in Los Angeles	in rest of S. Cal	in rest of US	in rest of world	
0 - 99	30.4	15.6	46.8	0.7	49
100 - 499	12.2	8.7	65.8	13.3	24
500+	12.6	5.9	65.2	11.8	20

Table 14. Geographic distribution of suppliers of questionnaire respondents by size of establishment.

Responents: size of establishment	Percent of suppliers: in Los Angeles	in rest of S. Cal	in rest of US	in rest of world	Number of establish-ments
0 - 99	61.4	14.7	23.4	0.4	49
100 - 499	41.1	18.8	23.6	2.2	21
500+	31.3	19.9	36.2	6.2	18

Table 15. Geographic distribution of customers of questionnaire respondents by percentage of sales made to the Department of Defense.

Respondents' percent of sales to DOD	Percent of customers: in Los Angeles	in rest of S. Cal	in rest of US	in rest of world	Number of establish-ments
0 - 33	25.0	15.0	49.0	12.0	31
33 - 66	23.0	11.0	57.0	10.0	23
66 - 100	18.6	9.3	62.5	7.2	40

Table 16. Geographic distribution of suppliers of questionnaire respondents by percentage of sales made to the Department of Defense.

Respondents' percent of sales to DOD	Percent of suppliers: in Los Angeles	in rest of S. Cal	in rest of US	in rest of world	Number of establish-ments
0 - 33	44.4	13.1	34.9	3.8	27
33 - 66	54.0	25.1	20.3	0.7	20
66 - 100	52.7	14.5	23.3	1.5	39

Table 17. NASA Prime Contract Awards for which First-tier Subcontracts exceed $10 million in aggregate, 1989. (Names of establishments in Southern California are set bold).

Prime contractor	Performance place	Contract number	Contract amount millions $	Total first-tier subcontracts millions $
California Institute of Technology	Pasadena, CA	NAS 7 918	1,053.6	731.1
Lockheed Space Operations	Kennedy Space Center, FL	NAS10 10900	551.5	40.8
Rockwell International	Downey, CA	NAS 9 17800	485.3	231.8
Rockwell International	Canoga Park, CA	NAS 8 40000	474.3	56.0
Rockwell International	Downey, CA	NAS 9140002	382.3	126.4
Rockwell Space Operations	Houston, TX	NAS 9 18000	286.8	86.7
McDonnell-Douglas	Huntington Beach, CA	NAS 9 18200	206.8	222.5
USBI Booster Production	Huntsville, AL	NAS 8 36300	197.9	61.9
Rockwell International	Kennedy Space Center, FL	NAS10 11500	196.6	70.5
Martin Marietta	New Orleans, LA	NAS 8 33708	190.8	15.3
EG&G Florida	Kennedy Space Center, FL	NAS10 10600	179.7	34.6
Lockheed Engineering and Science	Houston, TX	NAS 9 17900	158.2	27.2
Ford Aerospace	Palo Alto, CA	NAS 5 29500	129.6	27.4
Boeing	Marshall Space Flight, AL	NAS 8 50000	129.0	511.9
Bendix Field Engineering	Columbia, MD	NAS 5 31000	122.2	46.5
Boeing Computer Support Services	Marshall Space Flight, AL	NAS 8 38000	100.5	17.5
Rockwell International	Canoga Park, CA	NAS 3 250082	97.1	33.3
McDonnell-Douglas	Kennedy Space Center, FL	NAS10 11400	93.4	19.5
United Technologies	West Palm Beach, FL	NAS 8 36801	75.3	14.3
Lockheed Missile and Space	Sunnyvale, CA	NAS 8 32697	74.8	10.3
TRW	Redondo Beach, CA	NAS 8 36800	66.1	23.5
TRW	Redondo Beach, CA	NAS 5 30192	61.9	14.5

Martin Marietta	New Orleans, LA	NAS 8 36200	60.9	35.8
General Electric	King of Prussia, PA	NAS 5 33000	58.4	17.8
Boeing Computer Support Services	Marshall Space Flight, AL	NAS 8 37200	57.8	12.3
McDonnell-Douglas	Kennedy Space Center, FL	NAS 8323506	52.4	15.4
Ford Aerospace	Houston, TX	NAS 9 15014	49.9	18.0
Boeing	Reston, VA	NAS 9 17797	35.9	31.2
McDonnell-Douglas	Houston, TX	NAS 9 17885	35.5	13.0
IBM	Houston, TX	NAS 9 16920	34.3	12.2
Pan American World Services	Stennis Space Center, MS	NAS13 250	32.7	10.3
United Technologies	Windsor Locks, CT	NAS 9 17873	28.3	24.0
Martin Marietta	New Orleans, LA	NAS 8 36747	27.6	10.7
General Electric	Princeton, NJ	NAS 5 30350	19.2	16.5
Raytheon Service	Greenbelt, MD	NAS 5 34000	16.2	17.2
TRW	Redondo Beach, CA	NAS 8 37710	15.5	13.7
California Institute of Technology	Pasadena, CA	NAS 7 920	4.8	10.1
McDonnell-Douglas	Huntington Beach, CA	NAS 5 28100	(5.7)	10.6
Rockwell International	Canoga Park, CA	NAS 8 27980	N.A.	40.5
		Totals:	5,837.5	2,732.8

Source: NASA, NASA Obligations and Contract Value by Contractor for Fiscal Year 1989, (E-19 microfiche report, 1989).

Table 18. Flows of first-tier subcontracts by dollar value between major geographic divisions of the United States; flows are expressed as percentages of total activity.

		To first-tier subcontractors in:									
		New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
From prime contractors in:	New England	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.9
	Middle Atlantic	0.8	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.2	1.3
	South Atlantic	1.1	1.4	0.4	0.1	5.5	0.7	0.3	0.2	1.0	10.6
	East South Central	1.2	1.6	1.1	0.0	1.8	8.6	0.5	0.6	7.1	22.5
	West Sout Central	0.5	0.5	0.1	1.0	0.1	0.1	5.1	0.1	0.7	8.0
	Pacific	2.3	5.6	1.5	0.9	13.2	0.2	2.3	5.8	25.0	56.8
	Rest of US	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	5.8	9.1	3.2	2.0	21.5	9.6	8.1	6.7	33.9	100.0

Nb.: These first-tier subcontracts derive solely from the prime contracts designated in Table 2.
The total value of these subcontracts is $2,732.8 million.

Table 19. Flows of first-tier subcontracts by number of contracts between major geographic divisions of the United States; flows are express as percentages of total activity.

From prime contractors in:	To first-tier subcontractors in: New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
New England	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Middle Atlantic	0.3	0.2	0.3	0.0	0.0	0.0	0.0	0.1	0.3	1.2
South Atlantic	1.8	2.2	1.6	0.4	12.7	0.6	0.6	0.6	4.4	25.1
East South Central	0.2	0.6	0.3	0.1	2.3	4.8	0.7	0.2	1.7	10.9
West South Central	1.2	1.4	0.7	0.3	0.6	0.4	8.6	0.4	2.1	15.7
Pacific	2.8	3.2	1.8	0.9	3.0	0.7	1.4	3.1	30.0	46.9
Rest of US	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	6.4	7.6	4.7	1.8	18.7	6.4	11.3	4.4	38.6	100.0

Nb.: These first-tier subcontracts derive solely from the prime contracts designated in Table 2.
The total number of these subcontracts is 10,406.

Table 20. Flows of second-tier subcontracts by dollar value between major geographic divisions of the United States; flows are expressed as percentages of total activity.

		To second-tier subcontractors in:									
		New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
From first-tier contractors in:	New England	4.6	1.0	1.3	0.0	0.3	0.0	0.0	0.0	5.0	12.3
	Middle Atlantic	1.0	6.2	1.0	0.5	0.4	0.0	0.1	4.3	2.4	15.9
	South Atlantic	0.2	2.6	0.1	0.0	1.2	0.0	0.0	2.6	17.0	23.6
	East South Central	0.0	3.2	0.0	0.0	0.1	0.7	0.2	0.0	0.1	4.3
	West South Central	0.0	0.0	0.0	0.0	0.6	0.0	3.5	0.4	0.2	4.7
	Mountain	1.9	0.1	0.1	0.5	0.4	0.0	(4.6)	1.4	10.9	10.7
	Pacific	3.9	0.3	0.3	0.6	5.0	0.0	0.2	0.2	17.9	28.4
	Rest of US	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	11.6	13.4	2.9	1.6	7.9	0.7	(0.5)	8.9	53.6	100.0

Nb.: These second-tier subcontracts derive ultimately from the prime contracts designated in Table 2.
The total value of these subcontracts is $85.0 million.

Table 21. Flows of second-tier subcontracts by number of contracts between major geographic division of the United States; flows are expressed as percentages of total activity.

		To second-tier subcontractors in:									
		New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
From first-tier contractors in:	New England	16.1	2.1	1.5	0.1	0.4	0.0	0.3	0.0	7.2	27.8
	Middle Atlantic	2.7	5.2	1.3	0.3	0.5	0.0	0.3	0.7	3.5	14.5
	South Atlantic	0.8	1.1	0.8	0.0	1.7	0.1	0.1	0.7	2.3	7.7
	East South Central	0.0	1.6	0.3	0.0	0.4	2.6	0.1	0.1	0.4	5.5
	West South Central	0.1	0.1	0.0	0.0	0.3	0.0	5.0	0.5	0.4	6.4
	Mountain	1.9	0.5	0.3	1.2	0.8	0.0	1.6	2.1	8.7	17.2
	Pacific	0.5	0.9	0.8	0.3	0.1	0.1	0.3	0.8	17.0	20.9
	Rest of US	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	22.1	11.7	5.0	1.9	4.3	2.8	7.7	5.0	39.6	100.0

Nb.: These second-tier subcontracts derive ultimately from the prime contracts designated in Table 2. The total number of these subcontracts is 745.

Source: NASA (1989).

Table 22. Flows of first-tier subcontracts by dollar value between Southern California and the rest of the United States, 1989; flows are expressed in percentages of total activity.

		To first-tier subcontractors in:		
		Southern California	Rest of the United States	Total
From prime contractors in:	Southern California	21.3	34.1	55.4
	Rest of the United States	1.9	42.7	44.6
	Total	23.3	76.7	100.0

Nb.: Subcontracts derive solely from the prime contracts designated in Table 2. The total value of these subcontracts is $2,732.9 million.

Table 23. Flows of first-tier subcontracts by number of contracts between Southern California and the rest of the United States, 1989; flows are expressed as percentages of total activity.

		To first-tier subcontractors in:		
		Southern California	Rest of the United States	Total
From prime contractors in:	Southern California	25.7	19.6	45.3
	Rest of the United States	5.1	49.6	54.7
	Total	30.8	69.2	100.0

Nb.: Subcontracts derive solely from the prime contracts designated in Table 2. The total number of these subcontracts is 10,401.

Table 24. Flows of second-tier subcontracts by dollar value between Southern California and the rest of the United States, 1989; flows are expressed as percentages of total activity.

		To second-tier subcontractors in:		
		Southern California	Rest of the United States	Total
From first-tier subcontractors in:	Southern California	5.6	1.0	6.6
	Rest of the United States	39.4	54.0	93.4
	Total	45.0	55.0	100.0

Nb.: Subcontracts derive ultimately from the prime contracts designated in Table 2. The total value of these subcontracts is $85.0 million.

Table 25. Flows of second-tier subcontracts by number of contracts between Southern California and the rest of the United States, 1989; flows are expressed as percentages of total activity.

		To second-tier subcontractors in:		
		Southern California	Rest of the United States	Total
From first-tier subcontractors in:	Southern California	11.4	3.0	14.4
	Rest of the United States	17.9	67.8	85.6
	Total	29.3	70.7	100.0

Nb.: Subcontracts derive ultimately from the prime contracts designated in Table 2. The total number of these subcontracts is 745.

Table 26. Selected NASA prime contracts, first-tier subcontracts, and second-tier subcontracts in Southern California by County, 1989.

	Prime contract awards	Total subcontracts received			
		First-tier		Second-tier	
County:		by dollar value	by number	by dollar value	by number
Los Angeles	92.9%	75.1%	67.4%	56.3%	47.2%
Orange	7.1%	13.8%	20.1%	6.2%	17.0%
Riverside	0%	0.1%	0.8%	0.1%	1.4%
San Bernardino	0%	5.8%	2.4%	2.4%	10.6%
San Diego	0%	4.1%	4.4%	4.9%	7.8%
Santa Barbara	0%	0.4%	2.4%	20.4%	0.5%
Ventura	0%	0.8%	2.5%	9.7%	15.6%
Total	$2,842.1 M	$636.0 M	3206	$38.3 M	218

Nb.: Prime contract amounts shown here are taken from Table 10 (i.e. they represent awards for which first-tier subcontracts exceed $10 million in aggregate); all subcontracts derive solely from the prime contracts designated in Table 10.

Table 27. Flows of first-tier subcontracts by dollar value between the counties of Southern California, 1989; flows are expressed as percentages of total activity.

		To first-tier subcontractors in:							
		Los Angeles	Orange	Riverside	San Bernardino	San Diego	Santa Barbara	Ventura	Total
From prime contractors in:	Los Angeles	74.0	7.2	0.1	6.2	3.6	1.0	0.7	92.6
	Orange	0.9	5.7	0	0	0.6	0	0	7.2
	San Diego	0.2	0	0	0	0	0	0	0.2
	All other counties	0	0	0	0	0	0	0	0
	Total	75.1	12.9	0.1	6.2	4.0	1.0	0.7	100.0

Nb.: Subcontracts derive solely from the prime contracts designated in Table 10. The total value of these subcontracts is $584.5 million.

Table 28. Questionnaire respondents: projected employment change over next five years, by percentage of sales to DOD.

Percentage of sales to DOD	Expected employment change % of respondents in DOD category		
	Decline	No change	Grow
0 - 33	5.9	41.2	52.9
33 - 66	17.4	47.8	34.8
66 - 100	30.2	37.2	32.6

Table 29. Questionnaire respondents: actual and anticipated relocation of facilities, by size of establishment.

Size of establishment	Percentage of respondents		
	Have relocated activities	Will relocate activities	Number of establishments
0 - 99	20.0	18.2	55
100 - 499	38.5	30.8	26
500+	43.5	30.4	23
Total	56.4	24.0	104

Chapter 4

ECONOMIC IMPACTS OF DEFENSE CUTBACKS

by David Hensley and Daniel Flaming

SUMMARY OF ECONOMETRIC FINDINGS

- **If aerospace lay-offs continue through 1995 at 1990/91 rates the negative impacts by 2001 will include 184,300 fewer jobs in all sectors of the County's economy.**

- **Unemployment in the County economy caused by projected declines in aerospace employment will increase Unemployment Insurance costs $362.8 million and Public Assistance costs by $147.4 million over the coming decade.**

- **The cumulative losses to Los Angeles County's economy between 1992 and 2001 in personal income and retail sales, respectively, will be $86.4 billion and $23.8 billion.**

- **As a result of the weaker economy, 122,000 fewer houses will be built and $6.3 billion less will be spent on commercial construction.**

- **Based on a 1% property tax and an 8.25% sales tax, there would be a loss of $2.27 billion in property and sales tax revenues between 1992 and 2001.**

- **Every eight dollars in lost defense revenue will cause a twenty-eight dollar loss in the County's economy as well as a one dollar increase in costs and lost revenue for state and local government.**

- **These economic losses will reduce growth of the County's population by 328,000 people over the coming decade.**

Introduction

In an attempt to assess the economic impacts of federal defense cutbacks on the local economy, the UCLA Business Forecasting Project (UCLA-BFP) performed a simulation of its econometric model of Los Angeles County. The simulation experiment is designed to answer the question, "What if the County loses an additional 70,000 aerospace workers by 1995?" **This is not a forecast. It is an extrapolation of possible impacts from defense reductions based on recent trends in the aerospace industry.**

KEY ASSUMPTIONS OF THE SIMULATION

1. The simulation spans the ten year period from 1992 through 2001.

2. For purposes of the simulation it is assumed that aerospace employment falls by 17,500 jobs per year (the average of 1990 and 1991) from 1992 through 1995, for a cumulative additional loss of 70,000 jobs, then stabilizes thereafter.[1]

3. Based on previous UCLA-BFP studies, it is assumed that 250 non-aerospace subcontracting jobs in manufacturing are associated with every 1,000 aerospace jobs. This assumption results in a projected loss of about 22,000 directly linked aerospace manufacturing jobs in the County per year from 1992 through 1995.

Rationale

In early 1988, Los Angeles County aerospace employment reached its 1980's zenith of 223,000. Employment fell throughout 1988 and 1989, but the rate of decline accelerated in 1990 and 1991, when the losses averaged 17,500 per year. The model simulation assumes that the rapid rate of decline experienced in 1990-91 continues through 1995. Under this assumption total employment in the County's aerospace industry dips to 105,500 by 1995, a decline of over 50% from 1988.

The simulation identifies the marginal impacts of losing additional aerospace employment in the County, assuming no other public policy changes at the federal, state, or local levels. The simulation also reflects the job seeking and expected levels of reemployment of laid-off aerospace workers and the ripple effects of their lost income in the retail and housing sectors. The secondary effects of these lay-offs are considerable.

The standard of comparison for measuring outcomes is shown in Figure 1. The benchmark scenario in Figure 1 assumes that aerospace employment remains steady through the 1990's at 1992 levels. Other economic indicators, including employment in other sectors, personal income, retail sales, population growth and construction activity follow historically established patterns of the Los Angeles economy, taking into account the current recession.

SIMULATION RESULTS

The outcome of the model simulation is presented numerically in Table 1, and graphically in Figures 2 through 5. It should be noted that the values shown in the table and

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[1]Aerospace industries are comprised of Aircraft and Parts (SIC 372), Guided Missiles and Space Vehicles and Parts (SIC 376), and Search, Detection, Navigation, Guidance, Aeronautical, and Nautical Systems, Instruments and Equipment (SIC 381). This group of industries is a subset of the High Technology industrial group that is referred to elsewhere in this report. Aerospace and High Technology are both industry designations established by the California Employment Development Department. The econometric simulation discussed in this chapter is based on the Aerospace group because these are the industries that receive the highest proportion of their funding from the Department of Defense and also are the recipients of most defense prime contracts coming into the region.

Figure 1. L.A. County Employment in Aerospace

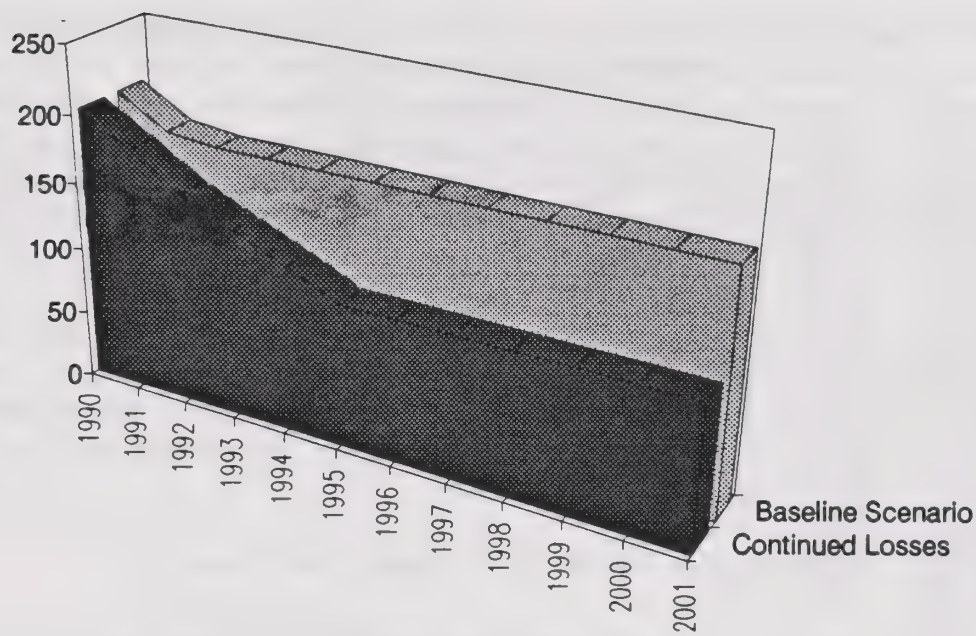


Table 1. Economic Impacts of Continued Losses in Aerospace Employment in Los Angeles County - Data Are Not Cumulative

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Personal Income, Taxable Retail Sales										
Personal Income (Billion $)	1.79	3.57	4.71	6.74	7.48	8.45	10.49	12.16	13.50	15.74
Real Personal Income (Bil 1982$)	0.72	0.80	0.89	1.70	1.82	2.54	3.41	3.79	4.25	5.01
Taxable Retail Sales (Billion $)	0.51	1.03	1.35	1.92	2.12	2.39	2.95	3.41	3.77	4.38
Real Taxable Retail Sales (Bil 1982$)	0.21	0.23	0.25	0.48	0.51	0.72	0.96	1.06	1.18	1.39
Employment and Labor Force - (Household Survey Thous.)										
Employment	37.2	70.1	86.0	114.5	116.9	121.8	141.5	153.1	158.1	172.5
Labor Force	9.1	24.1	39.6	58.5	73.7	86.7	101.4	115.7	127.9	140.9
Unemployment Rate (%)	-0.7	-1.1	-1.1	-1.3	-1.1	-0.9	-1.0	-1.0	-0.8	-0.9
Nonfarm Employment (Payroll Survey, Thous.)										
Total Nonfarm	39.7	75.0	91.9	122.4	125.0	130.2	151.3	163.6	168.9	184.3
Construction	3.8	10.1	12.6	14.0	13.7	11.2	10.9	11.3	10.1	9.5
Manufacturing	21.5	41.2	59.7	79.3	77.4	76.9	77.1	76.4	75.8	76.1
Durable Goods	21.7	42.4	62.5	83.1	82.0	81.8	81.9	81.4	81.1	81.3
Trade	4.8	3.6	1.3	4.7	3.4	7.4	12.8	14.0	15.7	20.1
Finance, Ins. & R.E.	1.0	1.5	0.8	1.4	2.1	3.0	5.3	6.7	7.5	9.1
Services	8.3	18.9	19.7	26.0	31.8	35.2	47.6	57.6	62.2	71.0
Population and Construction Activity										
Total Population (Thous.)	22.3	58.9	96.2	141.0	176.5	206.3	240.2	272.2	299.3	327.8
Residential Building Permits (Thous. Units.)	8.3	13.6	13.8	16.7	13.2	11.1	12.6	11.9	10.1	10.7
Nonres Con (Mil $)	337.8	578.6	620.2	788.3	658.3	585.1	702.6	702.9	627.5	698.7
Real Nonres Con (Mil 82$)	248.6	408.6	415.5	500.4	396.0	332.6	377.3	357.4	302.3	318.5

figures are losses, using 1992 levels as a starting point. Table 1 displays lost income, sales, employment, population, and housing that can be expected to result from lost aerospace unemployment. In the year 2001, County personal income and retail sales are projected to be 4% lower than if there had not been continued aerospace job losses. The weaker County economy causes a reduction in net inmigration to Los Angeles, resulting in a population that is 328,000 lower than it would be if the lay offs had not continued through 1995.

Economic losses are projected to continue for approximately five years after lay offs end. There is a higher level of certainty about the total magnitude of impacts shown in Table 1 than about the timing of the impacts. It is assumed that by 2001 the economy will have stabilized from the earlier aerospace lay offs, which are assumed to have ended in 1995, and that there would not be further job losses.

Projected Impacts on Personal Income and Taxable Retail Sales

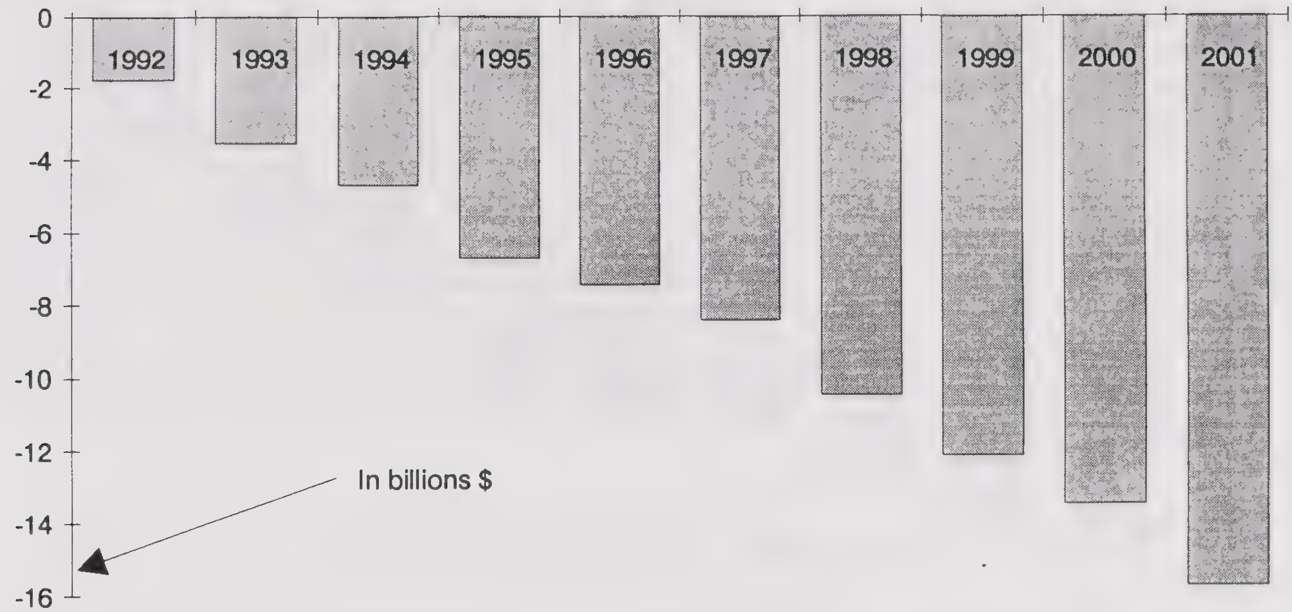
Projected annual losses in personal income as a result of continued aerospace lay offs will increase from $1.79 billion in 1992 to $15.74 billion in 2001, for a cumulative loss of $84.63 billion. This loss in buying power will result in a cumulative reduction in taxable retail sales of $23.83 billion. Based on an 8.25% sales tax, this would result in a cumulative loss of $1.95 billion in sales tax revenue in Los Angeles County.

Table 2
Lost Personal Income and Taxable Retail Sales

Year	Reduction In Personal Income (Billion $)	Reduction In Taxable Retail Sales (Billion $)	Reduction In Sales Tax Revenues (Billion $)
1992	1.79	0.51	0.04
1993	3.57	1.03	0.08
1994	4.71	1.35	0.11
1995	6.74	1.92	0.16
1996	7.48	2.12	0.17
1997	8.45	2.39	0.20
1998	10.49	2.95	0.24
1999	12.16	3.41	0.28
2000	13.50	3.77	0.31
2001	15.74	4.38	0.36
TOTAL	$84.63	$23.83	$1.95

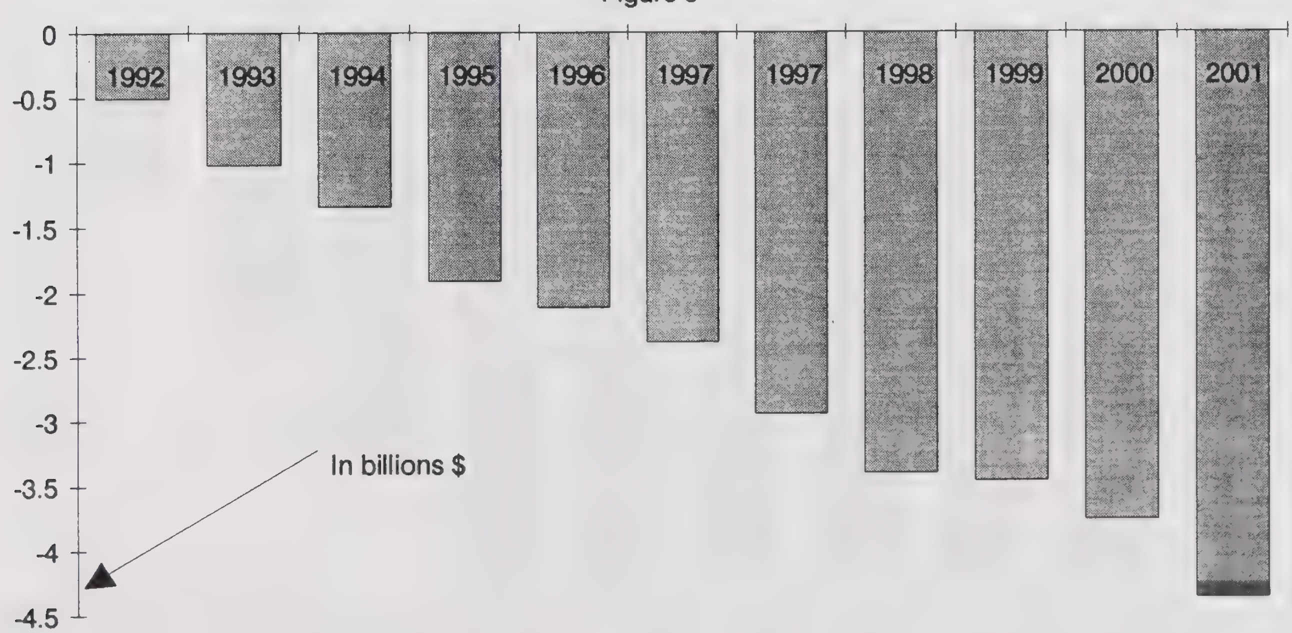
Loss in Personal Income

Figure 2



Loss in Taxable Retail Sales

Figure 3



Projected Impacts on Housing and Nonresidential Construction

In comparison with the benchmark scenario in which there are no further aerospace layoffs, the projection of impacts from continued lay-offs through 1995 shows that 122,000 fewer housing units will be built in the County and $6.3 billion less will be spent on nonresidential construction. The value of these unbuilt housing units is conservatively estimated to be $25.8 billion. This estimate has been arrived at by using $177,000 as the average price of new housing units sold in the County in 1992 and increasing this value by 4% percent per year through 2001.[2] The greatest annual losses in both residential and nonresidential construction are projected to occur in 1995, which is assumed to be the last year of aerospace lay offs in the econometric simulation. Based on a 1% property tax the lost property tax revenue will be $ 320.8 million. Additional losses in property tax revenues that could be expected to result from depressed resale prices for existing housing units caused by a smaller population with reduced buying power have not been included in this calculation.

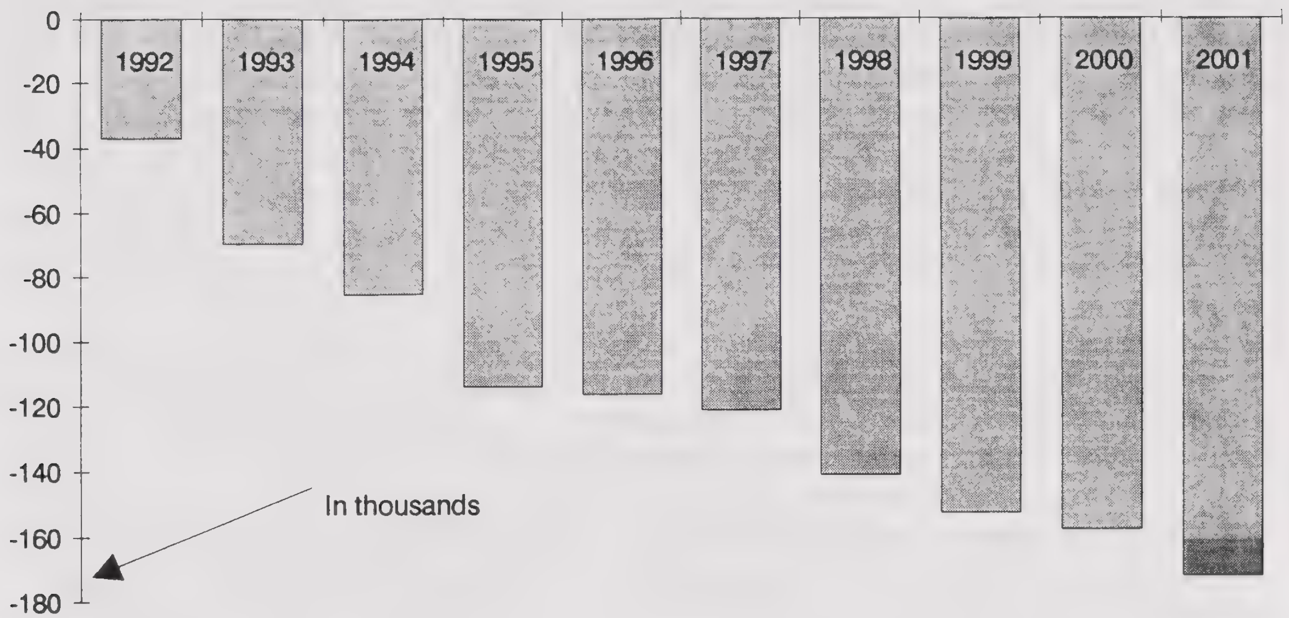
Table 3
Construction and Property Tax Impacts

Year	Number Of Housing Units Not Built (Thous. Units)	Value of Housing Units Not Built (Million $)	Reduction In Nonresidential Construction (Million $)	Reduction In Property Tax Revenue (Million $)
1992	8.3	1469.1	337.8	18.1
1993	13.6	2503.5	578.6	30.8
1994	13.8	2641.9	620.2	32.6
1995	16.7	3325.0	788.3	41.1
1996	13.2	2733.3	658.3	33.9
1997	11.1	2390.4	585.1	29.8
1998	12.6	2821.9	702.6	35.2
1999	11.9	2771.7	702.9	34.7
2000	10.1	2446.6	627.5	30.7
2001	10.7	2695.6	698.7	33.9
TOTAL	122.0	$25,799.0	$6,300.0	$320.8

[2]The $177,000 valuation of new housing units in Los Angeles County is an average of current prices for new condominiums and detached dwellings. The source of this price was Dataquick Information Systems, cited in the February 16, 1992, edition of the Los Angeles Times. This valuation is conservative because it represents a cyclical low point in real estate prices, and escalates that low point by a low cost of living increase of 4% per year.

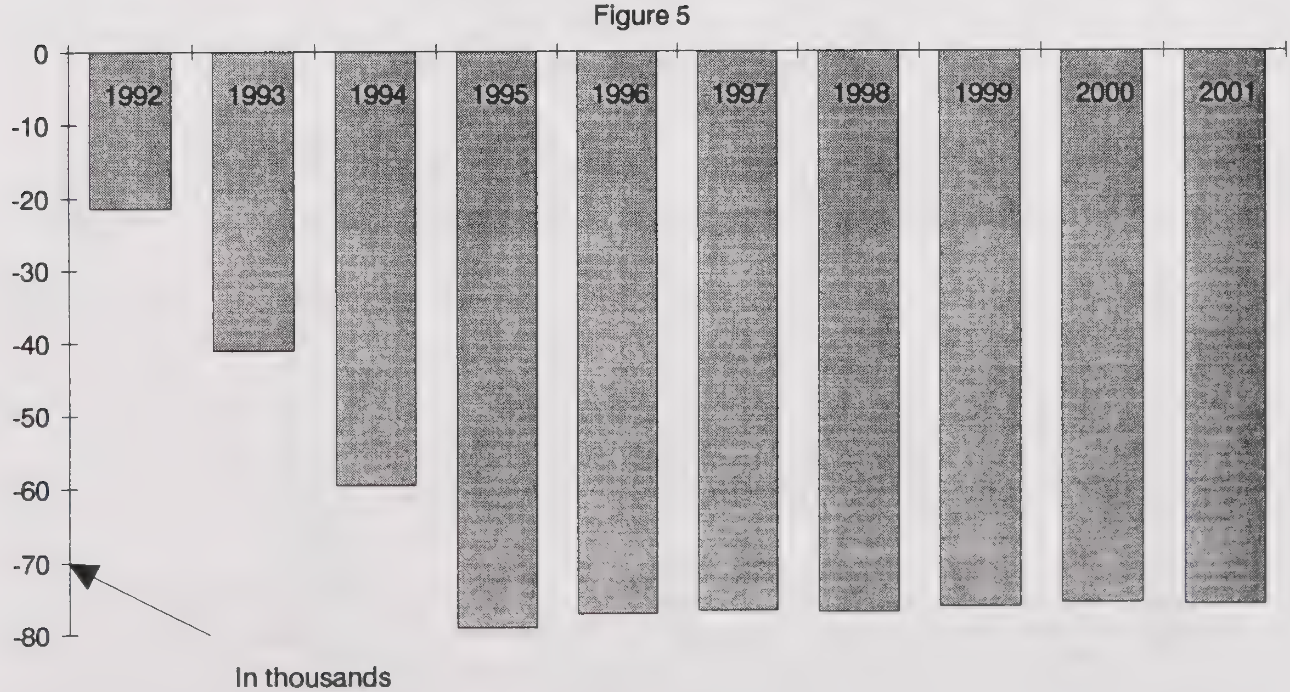
Loss in Total Employment

Figure 4



Loss in Manufacturing Employment

Figure 5



Public Costs for Increased Social Dependency

In addition to reduced public revenues from property and sales taxes there would be increased state and local costs for increased numbers of Unemployment Insurance and Public Assistance recipients. In 2001, nonfarm employment is down 184,300. The losses are across-the-board, but the biggest reductions other than manufacturing occur in retail and wholesale trade, and in services. These job losses will cause unemployed workers from all sectors of the workforce to need Unemployment Insurance and Public Assistance benefits over the coming decade.

Unemployment Insurance Costs

Increased public sector Unemployment Insurance costs for workers in all sectors of the economy who lose their jobs because of aerospace lay offs are estimated in Table 4. Cost estimates are based on findings in Chapter 6 that 53% of job losses identified in the Payroll Survey show up as Unemployment Insurance recipients receiving benefits for 6 months. The average amount of monthly benefits for Unemployment Insurance recipients in Los Angeles County is currently $580 per month. In calculating Unemployment Insurance costs, this amount has been projected to increase by 2% per year in anticipation of modest increases in future benefit levels. The fluctuations in aerospace-caused unemployment are based on UCLA-BFP's current forecasts for the Los Angeles economy over the coming decade. The year-to-year fluctuations in unemployment have less certainty than the overall projection that 184,300 jobs will be lost by 2001 as a consequence of losing another 70,000 jobs in aerospace between 1992 and 1995.

Table 4
Unemployment Insurance Costs

Year	Job Losses From Aerospace Cutbacks	Increased Number Of Unemployment Insurance Recipients	Cost (Million $)
1992	39,700	21,041	73.2
1993	35,300	18,709	66.4
1994	16,900	8,957	32.4
1995	30,500	16,165	59.7
1996	2,600	1,378	5.2
1997	5,200	2,756	10.6
1998	21,100	11,183	43.8
1999	12,300	6,519	26.1
2000	5,300	2,809	11.5
2001	15,400	8,162	33.9
TOTAL	184,300	97,679	$362.8

Public Assistance Costs

The size of Public Assistance caseloads is directly affected by the level of employment, particularly in entry level sectors of the labor market.[3] During the sixteen years from 1976 and 1991, the number of Public Assistance recipients in Los Angeles County have been 1.6 times as large, and the number of applicants for Public Assistance one-sixth as large, as the number of unemployed workers. During the most recent two years, 1990 and 1991, increases in the numbers of unemployed workers and Public Assistance recipients have been roughly equal, and the ratio of unemployed workers to Public Assistance applicants has been five-to-one, although applicants include not only unemployed adults but also family members.[4] Public Assistance recipients typically remain part of the caseload for

Table 5
Public Assistance Costs

Year	Job Losses From Aerospace Cutbacks	Increased Public Assistance Cases	Increased Public Assistance Costs (million $)
1992	39,700	6,617	31.8
1993	35,300	5,883	28.2
1994	16,900	2,817	13.5
1995	30,500	5,083	24.4
1996	2,600	433	2.1
1997	5,200	867	4.2
1998	21,100	3,517	16.9
1999	12,300	2,050	9.8
2000	5,300	833	4.2
2001	15,400	2,567	12.3
TOTAL	184,300	30,667	$147.4

[3]Individuals who have moved from the labor market to Public Assistance rolls are most likely to previously have been employed in entry level jobs and therefore are vulnerable to economic downturns that may occur in those sectors of the labor market. Because aerospace lay-offs will have negative secondary effects on employment in all sectors of the economy, it is reasonable to assume that it will affect some workers whose only income maintenance alternative after exhausting Unemployment Insurance is Public Assistance.

[4]This broad description of unemployment and public assistance trends summarizes discrete trends for the following eight public assistance programs: AFDC/FG, AFDC/U, General Relief, RRP, In-Home Support Services, Special Circumstances, Food Stamps, and Medi-Cal-Only. Even though there are far fewer applicants for Public Assistance than unemployed workers, the Public Assistance caseload is larger than the number of unemployed workers because it includes long term-recipients, and even individuals who are considered short-term recipients generally remain part of the Public Assistance caseload longer than the typical interval between jobs for unemployed workers. Information for determining ratios between unemployment and Public Assistance is taken from "L.A. County Welfare Caseload and Labor Market Trends 1976-1991," DPSS Research, Los Angeles County Department of Public Social Services.

two and one-half years.[5] The average monthly cost of a Public Assistance case in 1991 was $160.[6] This information is used in Table 5 to project a $147 million increase in Public Assistance costs if aerospace lay-offs continue through 1995.[7] This projection is a rough estimate. Because of the fiscal impact of Public Assistance on the County, linkages between increased unemployment among low wage workers and growth in Public Assistance caseloads merit further study.

Ratios of Defense Cutbacks to Economic Losses

Based on the quantification of public and private sector losses shown in Tables 2 through 5 it is possible to identify approximate ratios between reductions in defense expenditures and local economic losses. The UCLA-BFP simulation assumes that aerospace employment in 1995 will be half of what it was in 1988. If this reduction is assumed to be caused by a roughly equivalent reduction in defense expenditures in Los Angeles County, that would mean a reduction from $9.8 billion in 1988 to $4.9 billion per year after 1995. This, in turn, would mean a reduction of $600 million per year from the baseline year of 1992 through 1995. Thus, the losses in defense revenue as measured against the baseline model would be $600 million in 1992, $1.2 billion in 1993, $1.8 billion in 1994, $2.4 billion in 1995, and $3 billion each year from 1996 through 2001. This represents a total loss of $24 billion in defense revenue for Los Angeles County during the coming decade.

Table 1 shows cutbacks during the coming decade of causing a loss of $84.63 billion in personal income. Based on this projection, every dollar of lost defense revenue would result in three and one-half dollar loss in the general economy. This result is an estimate based on merging two different data sets; one data set includes most workers and the other includes only unclassified defense expenditures. Additional analysis is required to reduce the margin of uncertainty in this ratio.

Tables 2 and 3 also show the public sector losing $1.95 billion in sales tax revenues and $0.32 billion in property tax revenue. In addition, Tables 4 and 5 show increased public sector costs of $0.36 billion for Unemployment Insurance and $0.15 billion for Public Assistance. The total of lost public sector revenue from income and sales taxes, and increased Unemployment Insurance and Public Assistance costs during the coming decade is $2.8 billion. Based on this projection, every eight dollars in reduced defense expenditures would result in one dollar of lost revenue or increased cost for local government.

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[5] Paul Fast, Chief of DPSS Research, estimates that the approximate durations of enrollment in each Public Assistance program are: AFDC/G 36 months, AFDC/U 28 months, General Relief 6 months, Food Stamps 20 months.

[6] In calculating the costs shown in Table 5, this benefit level was held constant for the next ten years because of uncertainty about future levels of Public Assistance benefits in California.

[7] Total annual increases in nonfarm job loss caused by aerospace cutbacks that are shown in Table 1 are divided by six to arrive at the increase in Public Assistance caseloads caused aerospace unemployment. Cost is computed by multiplying the estimated number of additional Public Assistance cases by $160 a month for 30 months. Costs for Medi-Cal and public health services are not included in this estimate.

DISTRIBUTION OF ECONOMIC LOSSES WITHIN LOS ANGELES COUNTY

Aerospace unemployment has been disaggregated into twenty-three subregional areas in Chapter 6 to assist local government in planning for possible negative economic impacts of defense cutbacks. In Table 6, that follows, information developed in Chapter 6 to show subregional distribution of aerospace unemployment is presented along with zip code boundaries for each subregional area. The loss of aerospace jobs is the negative economic stimulus that causes other losses shown in Table 1. Therefore, all other things being equal, it can be assumed that the geographic distribution of losses in personal income, retail sales and employment will reflect the residential distribution of unemployed aerospace workers. It should be noted, however, that economic losses such as retail sales may occur adjacent to employment sites or in adjoining cities, depending on the shopping patterns of aerospace workers in each community. Information in Table 6 is intended to help local policy makers identify those communities which may be especially vulnerable to adverse impacts from aerospace lay-offs.

The patterns of aerospace unemployment shown in Table 6 indicate that the largest dislocations from aerospace unemployment will occur in:

Canoga Park
Lancaster
North Hollywood
Glendale
Torrance

A number of other communities are also likely to experience severe impacts from aerospace decline due to the high shares of community unemployment shown in Table 6 to be accounted for by aerospace job loss.

RECOMMENDATION

There are major uncertainties in the long term outlook for the Los Angeles economy. These include the decline in aerospace, environmental regulations, the pending Free Trade Agreement, shifting demographics, and the need to strengthen the educational system. The interactive elements of this complex problem merit careful attention from policy makers and long term research.

Table 6
COMMUNITY IMPACTS OF AEROSPACE UNEMPLOYMENT
Los Angeles County 1991

COMMUNITY	ZIP CODES	COMMUNITY SHARE OF COUNTY AEROSPACE UNEMPLOYMENT	AEROSPACE SHARE OF COMMUNITY UNEMPLOYMENT
Avalon (Venice/Hill)	90007, 90011, 90037, 90062, 90058	2%	3%
Canoga Park	91301, 91302, 91303, 91304, 91305, 91306, 91307, 91308, 91309, 91311, 91312, 91313, 91315, 91316, 91324, 91325, 91326, 91327, 91328, 91330, 91335, 91356, 91364, 91365, 91367, 91371, 91426, 91436, 90290	10%	15%
Carson	90704, 90710, 90731, 90732, 90733, 90744, 90745, 90746, 90747, 90748	2%	7%
Compton	90220, 90221, 90222, 90223, 90224, 90262, 90723	2%	7%
East Los Angeles and Lincoln Heights	90012, 90022, 90023, 90031, 90032, 90033, 90040, 90050, 90063, 91754	7%	6%
El Monte	91731, 91732, 91733, 91734, 91770, 91775, 91776, 91777, 91778, 91780, 91801, 91802, 91803	4%	8%
Glendale	90039, 90041, 90042, 90065, 91011, 91020, 91023, 91040, 91042, 91046, 91201, 91202, 91203, 91204, 91205, 91206, 91207, 91208, 91209, 91210, 91211, 91213, 91214	7%	9%
Hollywood	90004, 90005, 90010, 90020, 90027, 90028, 90029, 90036, 90038, 90046, 90048, 90068, 90069, 90072, 90074, 90075, 90076, 90210, 90211, 90212, 90213	2%	4%
Inglewood	90009, 90043, 90045, 90047, 90080, 90245, 90250, 90301, 90302, 90303, 90304, 90305, 90306, 90307, 90308, 90309, 90310	4%	9%

Lancaster	93501, 93505, 93510, 93516, 93523, 93532, 93534, 93535, 93536, 93539, 93543, 93544, 93550, 93551, 93553, 93560, 93563	10%	14%
Long Beach	90801, 90802, 90803, 90804, 90805, 90806, 90807, 90808, 90809, 90810, 90812, 90813, 90814, 90815, 90822, 90840, 90846	3%	7%
Los Angeles Central	90006, 90012, 90013, 90014, 90015, 90017, 90018, 90021, 90026, 90030, 90051, 90052, 90053, 90054, 90055, 90057, 90060, 90070, 90071	1%	2%
North Hollywood	91352, 91353, 91401, 91403, 91404, 91405, 91406, 91407, 91408, 91409, 91410, 91411, 91413, 91423, 91501, 91502, 91503, 91504, 91505, 91506, 91507, 91508, 91509, 91510, 91511, 91519, 91521, 91522, 91523, 91601, 91602, 91603, 91604, 91605, 91606, 91607, 91608, 91609, 91616	8%	11%
Norwalk and Lakewood	90240, 90241, 90242, 90638, 90650, 90701, 90706, 90712, 90713, 90714, 90715, 90716, 91716	5%	8%
Pasadena	91001, 91006, 91010, 91016, 91024, 91030, 91101, 91102, 91103, 91104, 91105, 91106, 91107, 91108, 91109, 91702	3%	8%
Pomona	91711, 91750, 91765, 91766, 91767, 91768, 91769, 91773, 91786, 91789	5%	10%
San Fernando	91310, 91321, 91322, 91330, 91331, 91340, 91341, 91342, 91343, 91344, 91345, 91350, 91351, 91355, 91402, 91412	4%	11%
South Central Los Angeles	90001, 90002, 90003, 90044, 90059, 90061	2%	4%
South Gate	90058, 90201, 90255, 90270, 90280	2%	5%
Torrance	90247, 90248, 90249, 90254, 90260, 90261, 90266, 90274, 90275, 90276, 90277, 90278, 90501, 90502, 90503, 90504, 90505, 90506, 90507, 90508, 90509, 90510, 90717	6%	11%

West Covina	91706, 91722, 91723, 91724, 91740, 91744, 91745, 91746, 91747, 91748, 91790, 91791, 91792, 91793	5%	12%
West Los Angeles and Santa Monica	90008, 90016, 90019, 90024, 90025, 90034, 90035, 90049, 90056, 90064, 90066, 90067, 90073, 90230, 90232, 90265, 90272, 90290, 90291, 90292, 90401, 90402, 90403, 90404, 90405, 90406	2%	5%
Whittier	90601, 90602, 90603, 90604, 90605, 90606, 90607, 90608, 90640, 90660, 90670	4%	10%
LOS ANGELES COUNTY TOTAL		100%	8%

Source: Employment Development Department, "Administrative Areas by Zip Codes," April 19, 1991; and Local Area Office B96 Reports for 1991.

Chapter 5

TECHNOLOGY COMMERCIALIZATION

by Daniel Flaming and Elizabeth Reid

SUMMARY OF FINDINGS

- **Large defense firms are not easily able to convert their technology and manufacturing resources to commercial projects. The public sector must become a central player in stimulating and guiding technology commercialization.**

- **Los Angeles County needs an industrial development strategy for building incrementally on the core strengths and capabilities of each segment of its high technology infrastructure.**

- **Restrictions on open communication and collaboration that have been ingrained in defense contractors by the Department of Defense are slowing the pace of technological innovation in the County's high technology industrial complex.**

- **Large aerospace firms are still devoting a majority of their research and development efforts to developing new products for the Department of Defense.**

- **Small firms are the most active and innovative in developing new commercial products using advanced technologies.**

- **Large firms are twice as likely as small firms to place a high priority on reducing the size of their work force.**

- **Even though a majority of large aerospace firms have indicated that they intend to move some or all of their work out of the County in the next five years, fewer than one in ten indicated that this was a top priority for remaining competitive.**

- **Other regions have built highly effective alliances of government, industries and universities to guide a consensus-based approach to industrial development. These alliances have gone through stages of growth that include:**

  - **Learning how to get along together.**
  - **Deciding how to share intellectual property.**
  - **Cooperating around a common interest in sharing information.**

- **Helping high technology firms grow is a difficult, complex task that will require new organizations with expert staff dedicated solely to this effort.**

INTRODUCTION

The massive presence of defense related industries has decisively shaped Los Angeles County's economy, creating regional assets that are going unused as defense procurement declines. There is a powerful intuitive appeal to the idea of converting these industrial capabilities to markets outside of defense to provide a productive use for:

1. One of the largest pools of skilled professional, technical and production workers in the world.

2. Extremely large investments of public and private funds in high technology manufacturing facilities and equipment.

3. A very large network of specialized high technology firms who obtain a shared competitive advantage from their mutual presence in Los Angeles County.

4. Intellectual property in advanced technological areas that could be applied to commercial and public sector needs.

At the request of the Los Angeles County Board of Supervisors the Economic Roundtable has worked with local aerospace firms and research universities over a fifteen month period to explore conversion of surplus research and advanced manufacturing resources to civilian applications. This chapter describes the serious obstacles and the opportunities that have been identified through this effort and recommends actions to support the growth of advanced technology industries that are independent of defense funding.

Industry Constraints
Exploratory contacts were made with ten of the largest aerospace firms in Los Angeles County to identify opportunities for applying their technological resources to problems outside of the defense sector. These contacts revealed serious obstacles to commercial diversification of the largest defense contractors. Obstacles that constrain aerospace industrial diversification have been identified based on past experience (and failures) of defense firms attempting to diversify as well as their firmly held perceptions of their own limitations:

1. Firms which are primarily in the defense business have high overhead costs intrinsic to their organizational structure because they have had to be intensively managed to be responsive to Department of Defense (DOD) oversight. This is not something that can be quickly changed.

2. Because of DOD and NASA requirements, defense firms are organized to engineer and build their products to standards far exceeding those required for commercial work, making their products comparatively expensive.

3. Most large defense firms have very little familiarity with commercial markets.

4. Large defense prime contractors are organized to concurrently manage diverse knowledge bases to solve complex technological questions and then, based on those solutions, to manage complex manufacturing systems to build small quantities of products over comparatively short periods of time. This orientation toward high engineering costs and small production volume makes it difficult for them to be cost competitive in commercial markets.

5. Large defense prime contractors are accustomed to operating under a high degree of control from the Department of Defense with relatively little financial risk to themselves. This creates an organizational culture unsuited for the risk taking and initiative required to compete in commercial markets.

Because of their awareness of these constraints, Los Angeles County's aerospace firms are cautious about putting their own capital at risk in attempting to diversify into commercial markets, yet they also indicate an interest in finding ways to use their technological capabilities for solving new kinds of problems. This assessment of aerospace reluctance to take risks associated with directing their technological assets toward nondefense markets is borne out by a separate recent investigation of Los Angeles County's aerospace industry which found:

> In spite of general agreement among executives about the impending reduction in the defense budget, there was considerable wariness on the part of defense companies in exploring new business outside the defense sector. . . . There was no concerted effort in these companies to identify mechanisms to create new businesses in other growth areas which could utilize their technological skills.[1]

In a second report one of these same investigators concluded:

> Few companies have major diversification strategies. The real emphasis was attention to downsizing while maintaining previously attained profit levels.[2]

Transitional Strategies

A transitional diversification strategy which took account of defense industry constraints was explored with a number of large aerospace firms by investigating their interest in responding to technologically complex State and local public sector problems which require research and development activities that will lead to significant future levels of manufacturing. Projects of this nature would provide a structured relationship with a governmental entity that would have some of the same requirements for carefully regulated

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[1]Sam Hariharan and Mike Lambert, "Growing in the Post Cold-War Era, Strategic Responses of Defense Companies," unpublished report, December 6, 1991, pp. 2-3.

[2]Michael C. Lambert, "Swords Into Smaller Swords, Not Plowshares," unpublished report, January 5, 1992. p. 3.

procedures as characterize defense contracts. And they would utilize the primary strength of aerospace contractors, which is the management of multiple knowledge bases to produce innovative technological solutions. The overlapping areas of environmental quality and advanced transportation systems were identified as areas that might utilize aerospace organizations and technology because the public sector is to be the primary customer and these problem areas require very high standards in engineering and manufacturing. All ten of the large aerospace firms that were contacted responded with interest to proposals that they participate in projects related to transportation and environmental quality, but most of these firms qualified this interest by:

- Requesting definitive descriptions of the proposed projects, rather than feeling knowledgeable enough about these markets to participate collaboratively in developing the projects.

- Indicating strong reluctance to invest their own funds in commercial projects.

Both responses are characteristic of past aerospace practices in which the Department of Defense issued detailed specifications for projects and minimized the need for aerospace firms to put their own funds at risk.

The significance of these responses is that there is no broad and easy road to industrial diversification in Los Angeles County. The simple and seemingly practical solution of relying on large, sophisticated aerospace companies to take the initiative in applying their technology, manufacturing facilities and work forces to large scale civilian problems turns out upon closer examination not to be a viable solution. Industrial diversification projects can not be expected to emerge from aerospace firms on a scale that will significantly offset defense cutbacks unless the public sector provides transitional support through financial assistance, guidance, and a reliable market. This fact that the public sector must become a central player in supporting industrial diversification of the County's high technology sector leads to the further conclusion that this support should be broadly shared and not arbitrarily favor any particular industry segment. Industrial diversification efforts should not focus solely on existing large firms, but also include strategies for supporting industrial growth by:

- Facilitating business agreements spinning-off technologies with commercial potential from large, defense dependent firms and placing them with entrepreneurially oriented, small businesses to be commercialized.

- Supporting the growth of small high technology firms that are already active in commercial markets.

- Supporting start-up businesses utilizing skills and ideas in the large pool of unemployed aerospace workers.

- Creating alliances between research universities and high technology firms to commercialize new technologies.

Each of these strategies entails building incrementally on the existing strengths and capabilities of a particular segment of the high technology infrastructure in Los Angeles County. To guide public sector intervention strategies the Economic Roundtable's aerospace survey included a group of questions designed to provide a better understanding of activities, prospects and needs related to technology commercialization in different sectors of the County's high technology industrial base.

TECHNOLOGICAL COMPETITIVENESS

Upgrading technology

High technology firms were asked to indicate how they upgrade the technologies used for their manufacturing or services.[3] The survey found that the most widespread source of new technology is in-house research and development, although there is a significant difference in the percentages of large and small firms underwriting their own research (Figure 1). All of the very large, defense dependent firms (more than 1,000 employees and 97% defense dependent) have in-house research and development staffs. These research and development activities, however, are largely directed toward Department of Defense (DoD) projects. In contrast, small high technology firms (100 or fewer employees) look forward to developing very diverse commercial products with more limited R&D resources. Less than two-thirds of the small firms have an in-house research staff.

Three-quarters of the large high technology firms also use university research programs and outside consultants, whereas small firms make almost no use of university research programs and only a quarter of them use outside consultants. These differences suggest that small firms might benefit from having better information about, and access to, researchers and specialists who are knowledgeable about their technological problems. Large and small firms are similar in that about two-thirds of each report that they use trade associations to acquire the newest technology.

Less than half of the large firms and only a quarter of the small firms report using other firms to keep up with new technology. These collaborative efforts with other firms appear to most frequently result from subcontracting relationships. The limited occurrence of interfirm collaboration for developing competitive technology reflects limitations on communication that result from DoD security requirements as well as the highly structured relationships that exist between defense firms and the government. The tradition of DoD restrictions on open communication and collaboration have slowed the pace of technological innovation. However, firms that ask cutting edge technological questions and generate answers in ways that are mutually beneficial often solve important technological

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[3]See Chapter 1 for a full discussion of survey methodology and findings. The survey instrument is shown at the end of Chapter 1. Responses about technology commercialization and competitive strategies were obtained through questions in Part III, "Business Opportunities," pages 4 and 5 of the survey.

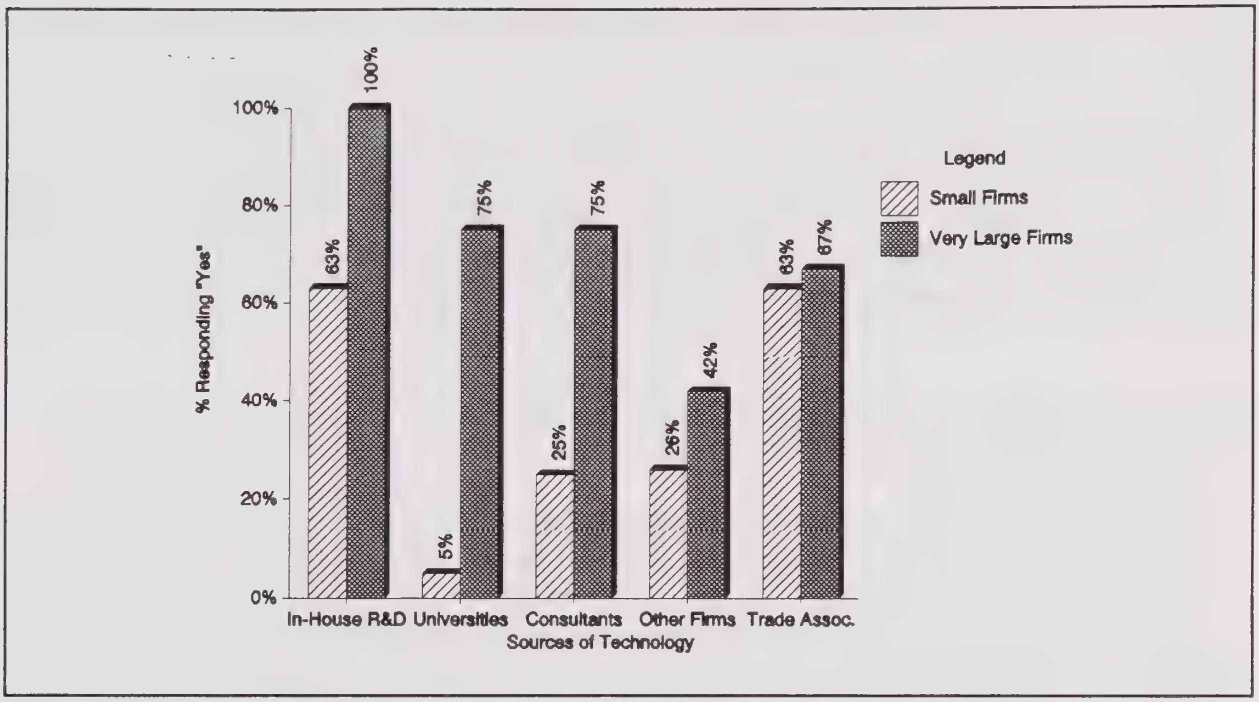

Figure 1 Sources of New Technology by Firm Size

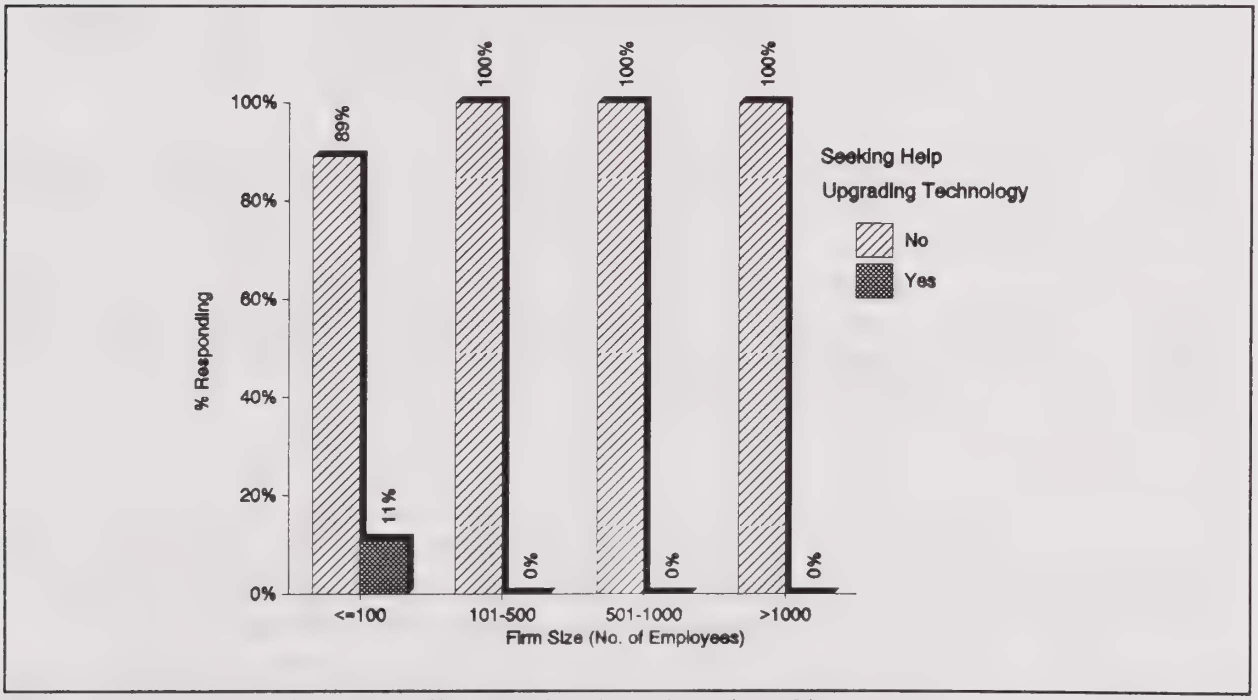

Figure 2 Help Sought Upgrading Technology by Firm Size

problems and become leaders in their fields. Los Angeles firms could learn from other U.S. businesses, and European and Asian counterparts, about collaborating with each other. Firms within a large, regional high technology complex can leverage their capabilities through linkages with other firms that have complimentary needs or capabilities. These

dynamic linkages between firms, often firms in a customer-supplier relationship, are a fundamental force in stimulating accelerated cycles of technological development.[4] One of the key challenges for Los Angeles County is finding ways to foster a stable, confident industrial environment which encourages collaborative rather than insular relationships in its high technology industrial complex.

Firms were asked whether upgrading their technology was a problem for them. Only small firms, and only about one-in-ten of them, indicated that getting access to new technology was a problem for them and wanted help in this area (Figure 2). Even though this is a highly competitive, constantly changing industry, Los Angeles firms do not indicate a high level of concern about dealing with the technological dimension of their businesses. Despite their apparently modest level of interfirm alliances that serve to develop new technology, this response reflects the mutual benefit that firms gain from being part of this region's dense concentration of advanced technological activity.

Business Innovation

The survey asked firms to identify their three most promising products for the next five years. Large aerospace firms, which are heavily dependent upon the DoD, indicate that they are continuing to concentrate their research resources on developing and improving products for the government. About half of the new products they are developing are solely for the government with no possible commercial applications unless the product is drastically altered, i.e., tactical missile fin actuation, Bradley tank modification, or indirect fire training simulators. The other half of the new products being developed by large firms appear to be geared toward the government as a client, but may have significant commercial applications such as fiberoptics. Only one of these firms has begun to look into alternative fuel vehicle technologies.

Despite their limited resources for R&D, small firms are developing very diverse product lines that cross industry boundaries and very seldom are dependent upon the DoD as a customer. Areas of innovative product development by small firms include electronics, medical-related products, fiberoptics, computers, measuring instruments, aircraft parts, and hardware. Also coming out of small firms are advanced, commercially viable products such as new pacemaker models, optic innovations for microscopes, advanced composite materials, optical data loaders, battery technologies, memory modules, and advanced fare collection systems.

Competitive Strategies

Firms were asked to rate the strategies they use to remain competitive in aerospace and high technology. Competitive strategies being used by firms are shown in the table below in rank order of their importance.

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[4] Martin C. Libinki, What Makes Industries Strategic, The Institute for National Strategic Studies, 1989, pp. 23-28, 33, 65, 70.

Table 1

Strategy	% Very Important
Quality Improvement Programs	67%
New Product Development	47%
Product Improvement	46%
Just-In-Time Delivery	40%
Inventory Management	38%
Expediting Product Development	37%
New Markets for Existing Products	32%
Information Technology	31%
Market Forecasting	24%
Increasing Research and Development Expenditures	18%
Downsizing Work Force	16%
Upgrading Plant and Equipment	11%
Relocation to Another Region	10%
Acquisitions or Mergers With Other Firms	7%
Decreasing Research and Development Expenditures	3%

The most widely espoused competitive strategy is quality improvement. Quality improvement programs have been promoted by the Department of Defense, making them prevalent among large aerospace firms and their subcontractors. They also are widely regarded as a basic tool for integrating customer responsiveness, information technology, worker productivity, and manufacturing efficiency. The least popular strategy was decreasing research and development. In between these extremes there were significant differences in the strategies pursued by large and small firms, with large firms having the resources to concurrently pursue more programs for remaining competitive.

Survey responses suggest that large aerospace firms are beginning to recognize the need for diversification, whereas small firms do not feel at a competitive disadvantage with their current array of products. New product development is considered to be very important by all very large firms, but only a third of the small firms (Figure 3). Product improvement is also a very important strategy for 75% of the very large firms, but only 41% of the small firms (Figure 4). Reflecting their superior ability to support research and development, twice as many very large firms indicate it is very important to increase their R&D to remain competitive as do small firms (Figure 5). These responses suggest that because of their lack of R&D resources, fewer smaller firms are implementing strategies which link research to product improvement and new product development. However, those smaller firms that are able to compete in new product development may have a competitive edge over larger firms because of their ability to get products to market more quickly.[5] The priority placed on expediting product development in order to stay competitive increases as firm size increases (Figure 6).

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[5] "Survey of Strategic Issues for Southern California High Technology Companies," KPMG Peat Marwick, February 1991.

Figure 3. NEW PRODUCT DEVELOPMENT
By Firm Size

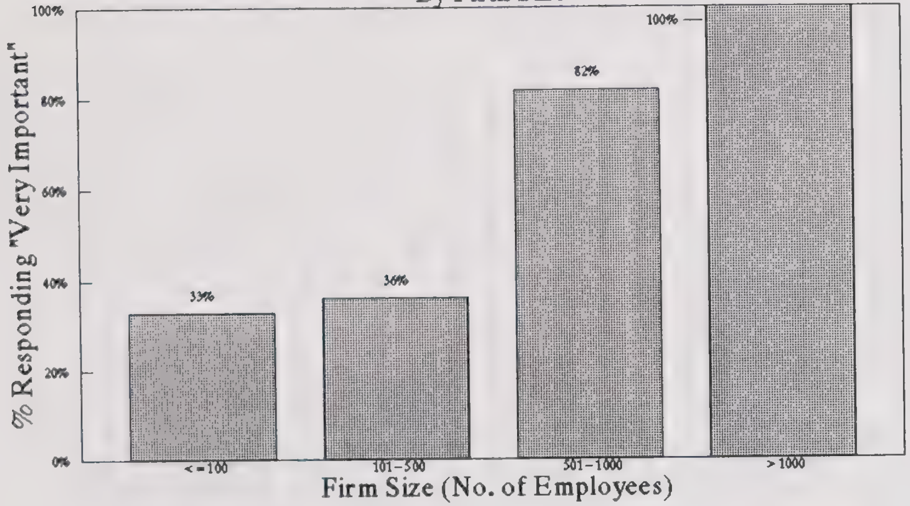


Figure 4. PRODUCT IMPROVEMENT
By Firm Size

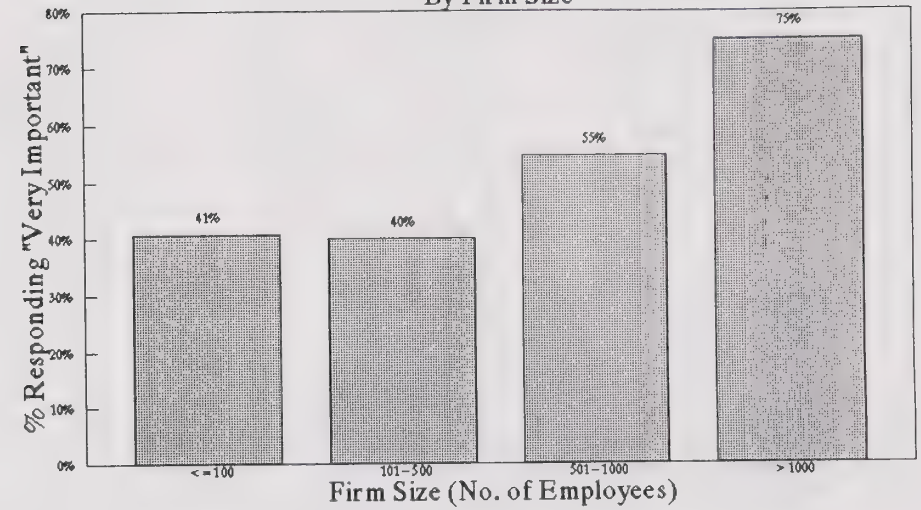


Figure 5. INCREASE R&D
By Firm Size

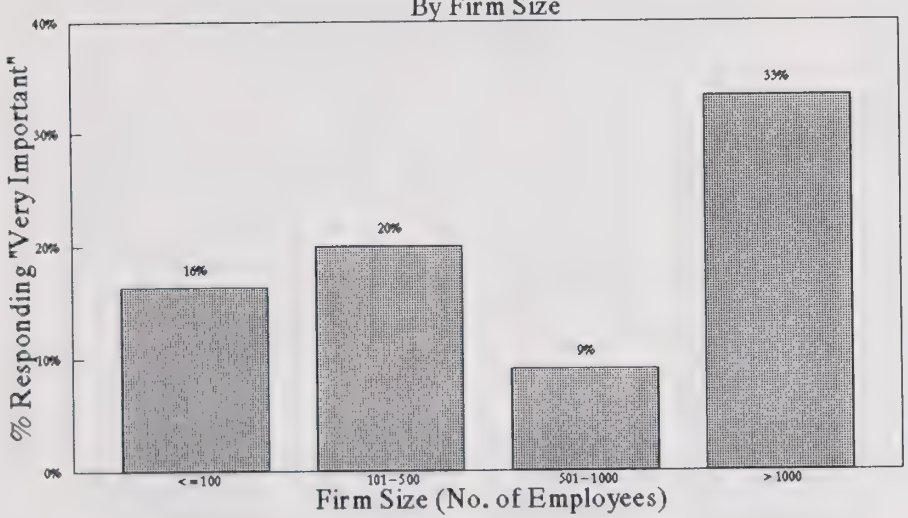
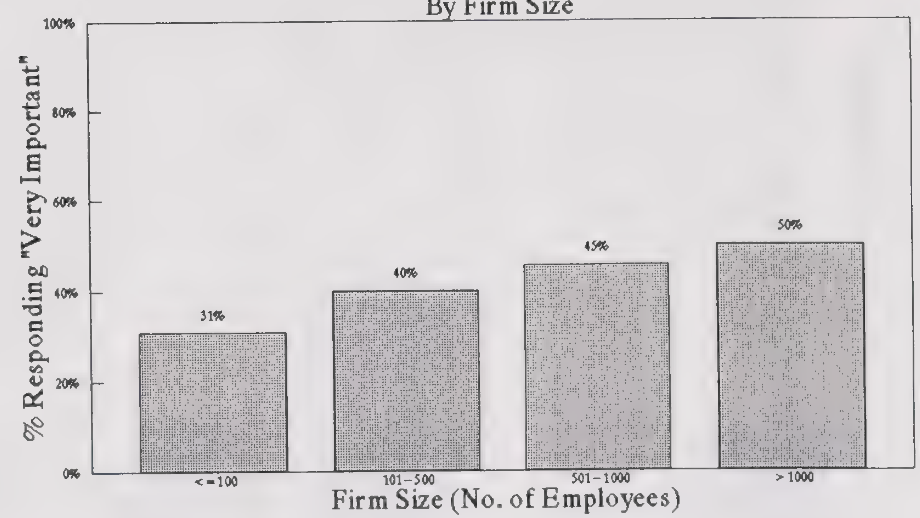


Figure 6. EXPEDITE PRODUCT DEVELOPMENT
By Firm Size



Information technologies, such as online vendor and supplier systems and interfirm computer linkages, that provide strategic market and production data are very important to more than half of the larger firms and nearly a third of the smaller firms (Figure 7). Installing information systems can be expensive, as can upgrades, and while this may be essential for providing "real time" information in large organizations, small firms are more reluctance to invest in information systems rather than relying on casual information flows from their own staff, trade associations and other firms.

With sizeable staffs in market research and sales, the largest firms are twice as likely as the smallest firms to place top priority on using market forecasting to keep ahead of their competition (Figure 8). For instance, large aerospace firms are much more in touch with changes taking place on Capitol Hill that could affect their market in five to ten years. They can also keep up with changes and opportunities in foreign markets. Again, smaller firms with their smaller staffs and more limited resources do not emphasize market forecasting as a competitive strategy, no doubt depending more upon their trade associations and related information sources.

Downsizing the work force is a very important competitive strategy for a third of the largest firms (Figure 9). The payoff, at least in the short term, of cutting costs faster than revenues fall is reflected in current news headlines reporting that some aerospace firms laying off workers are also posting some of their most profitable returns in recent years. Medium size firms are the least likely to place a high priority on downsizing as a competitive strategy. The very small firms, which cannot afford to work at less than capacity and must reduce staff when work is reduced, are twice as likely as medium size firms, but only half as likely as large firms, to say that downsizing is a very important strategy.

Only eight percent of the very large firms indicate that relocating to another region is a means of staying competitive in the market (Figure 10). And yet elsewhere in the survey 64% of these same firms indicate that they anticipate relocating some or all of their employees in the next five years. There are several possible explanations for this discrepancy. One is that being located in Los Angeles County is a competitive advantage in high technology industries, despite grumbling about environmental regulations and unresponsive government. Many firms recognize that California leads the regulatory curve and that much of what is true for California eventually becomes true for the rest of the country. This explanation suggests that most firms are making normal business decisions to move those jobs that are most price sensitive. A second possible explanation is that relocation decisions are not a response to problems in Los Angeles County, but rather a response to disadvantages resulting from logistical difficulties in connecting facilities in Los Angeles to other corporate facilities at a time when the market is declining and all facilities are under utilized. For example when there is a drop in production, a firm with corporate headquarters and its main manufacturing site in St. Louis and branch facilities in other cities, may contract back into its original manufacturing site or its most efficient and appropriate facilities given the type of product for which it still has a market. Most importantly these responses suggest that firms are not wedded to the idea of relocating and

Figure 7. INFORMATION TECHNOLOGY
By Firm Size

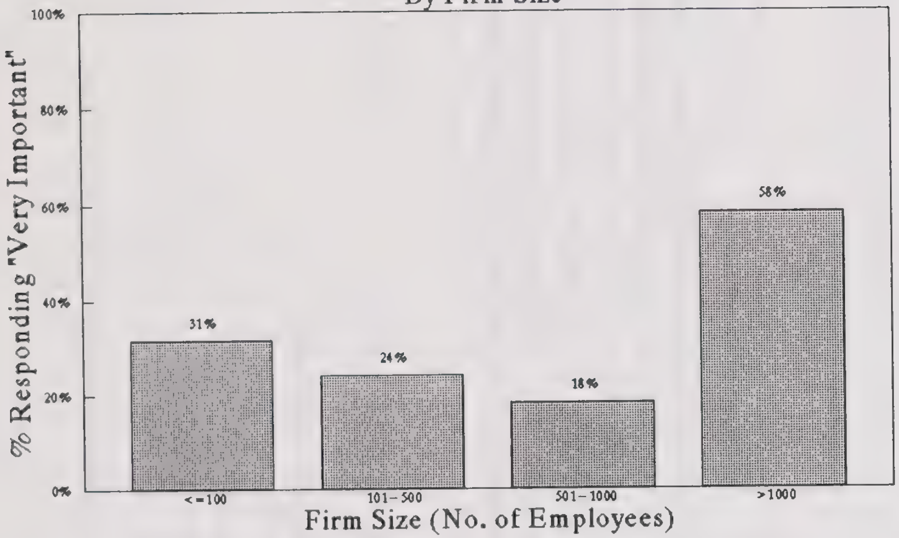


Figure 8. FORECASTING MARKETS
By Firm Size

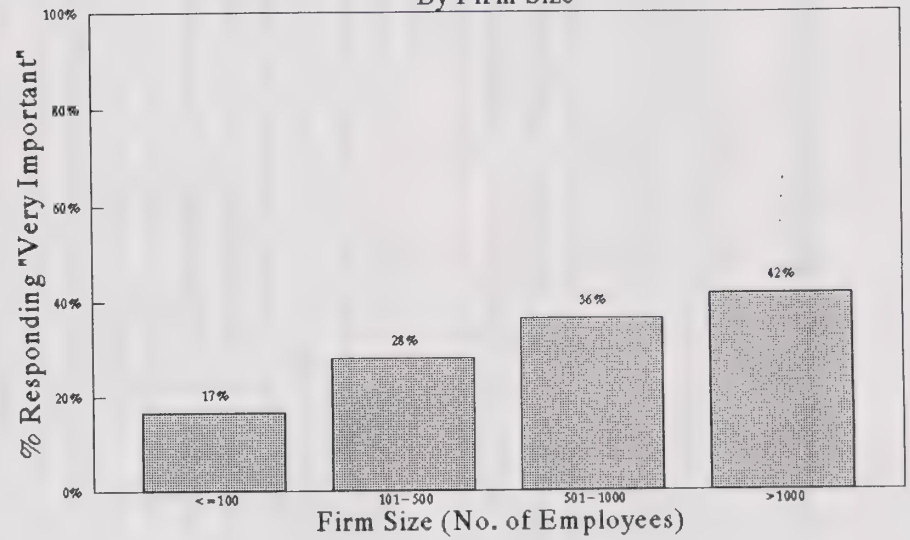


Figure 9. DOWNSIZE WORKFORCE
By Firm Size

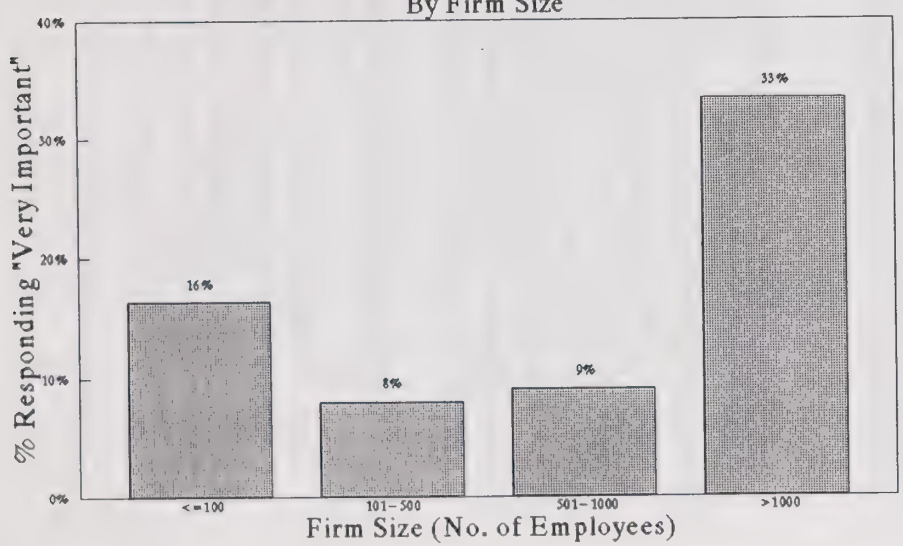
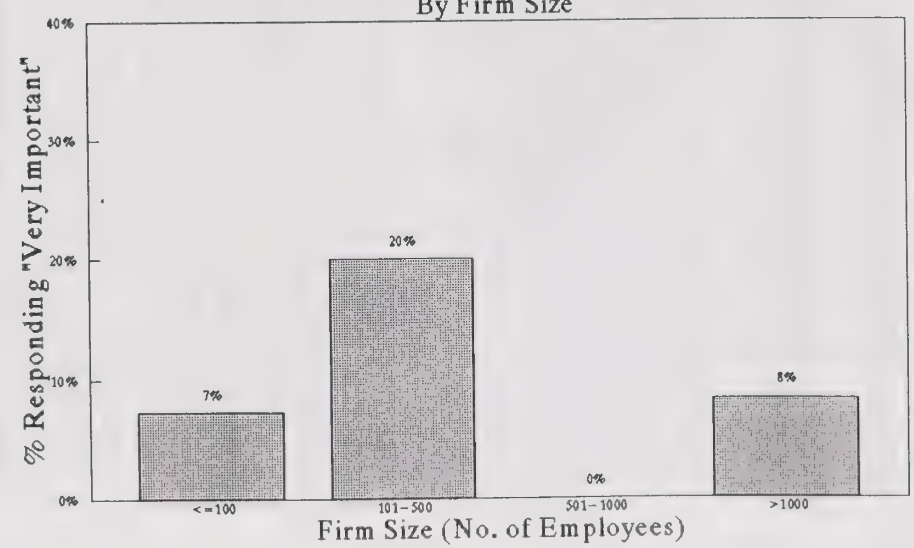


Figure 10. RELOCATE TO ANOTHER REGION
By Firm Size



perhaps work by local government could persuade some of the firms planning to relocate that they should remain in Los Angeles County.

The survey findings identify several possible public sector strategies for strengthening the high technology base in Los Angeles County. Large defense firms already have enormous research resources and a great deal of experience in managing those resources. As much as possible, these firms should be encouraged to diversify their immense R&D resources into projects with more commercial applications. Where these firms are uncomfortable entering markets with technology that has commercial applications, spinning those technologies off to smaller firms with entrepreneurial experience is a sensible option.

The sector that is most dynamic in quickly advancing new technologies into commercial markets is the small high technology firms. They show remarkable vitality given their limited research and development resources. If given broader access to resources, they could be expected to grow at an accelerated rate and offset a larger share of the job loss that is occurring because of defense cutbacks. One strategy would be to increase research and development resources for small firms by making university research programs more accessible to them, providing testing facilities for new products and prototypes, and enhancing interfirm linkages so that firms with challenging requirements for new technologies can be more efficiently paired with firms capable of responding to those requirements. A follow-on strategy for helping small firms exploit new technologies developed through improved research linkages would be merit-based financial assistance programs. In addition, entrepreneurial training could increase the number of successful start-up firms by providing technical assistance and seed funding to individuals in the high technology work force who have innovative ideas.

LESSONS FROM OTHER REGIONS

Public sector strategies for supporting the growth of advanced technology industries were explored through interviews with twenty-seven individuals representing sixteen organizations in Boston, Worcester, Philadelphia, Pittsburgh, and Cleveland.[6] These cities were chosen because each has long standing, highly visible economic development programs based on partnerships of government, industry and universities. At each site a group of core issues was explored to identify program strengths applicable to Los Angeles as well potential pitfalls to be avoided. These issues included:

1. Strategies for commercializing technological assets.

2. Structure and scope of economic development activities.

3. Types of businesses targeted for assistance.

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[6]Travel expenses for this trip were underwritten by the Economic Development Corporation of Los Angeles County.

4. Types of institutional and community support provided for the programs.

5. Program outcomes.

6. Characteristics of economic restructuring in each region.

Findings from each city are presented below, followed by a summary of key findings that are relevant to the development of technology commercialization programs in Los Angeles County.

Boston

BACKGROUND: Since the late 1980s, Massachusetts has lost 400,000 jobs in advanced technology industries due to decline in the microcomputer industry, movement of General Electric's aircraft engine manufacturing activities to Ohio, and the current recession. The state has large scale research programs for biotechnology and the strategic defense initiative, but little manufacturing activity has resulted. They remain a parts supplier for the jet engine industry; a small, stable, profitable niche.

Under the previous governor the State established "Centers of Excellence" in biotechnology, polymers, micro-electronics, software, and manufacturing technology. With the exception of micro-electronics, the Centers are not a physical location but rather industry groups organized to articulate their needs to government. Previously, these industries were fragmented and the State was not aware of their needs. The State has played an organizing role in forming the Centers and has been responsive to them through job training programs and changes in tax laws.

The State also encourages cities to adopt "science friendly zoning" for surplus government property and vacant land. This zoning allows industrial activity that meets National Institute of Health standards, and enables the locality to utilize environmental reviews already conducted by the State, thereby expediting the development process.

The micro-electronics center was created through matching contributions of $20 million each from the State and the computer industry. It was an attempt to foster manufacturing of computer chips. After a short interval of training and testing use, the equipment has become nearly obsolete and the State is abandoning the center.

LESSONS:

- Major capital investments in facilities to stimulate new technologies are risky. They need to be backed by:
    - An identifiable, clearly delineated market opportunity.
    - A broad base of institutional support in which all of the players have a long term self-interest in continued participation.

Worcester

Worcester lost its manufacturing base in textiles in the 1970's. The Chamber of Commerce created a blue ribbon group to study the problem. This panel, chaired by the dean of the University of Massachusetts Medical School, recommended using 100 acres of surplus university land to create a biotechnology research park. There have been at least two significant outgrowths from the panel's recommendations, although neither has led to increased amounts of new manufacturing. The first has been development of a very successful biotechnology research park, and the second is a high level of entrepreneurial activity in biotechnology research from the spin-off activity of the Massachusetts Institute of Technology and facilitated by the University of Massachusetts' research park. Each area of activity is discussed separately below.

The Massachusetts Biotechnology Research Park has 660,000 square feet building space developed or under construction. This has been a profitable process and has enabled them to support both venture capital activities and an incubator program. In terms of the larger economy, the tenants are commercial research groups who "print red ink" for at least the first six years of operation and are often acquired by larger firms when it becomes necessary to make large capital investments for manufacturing. There are indications that the manufacturing activity growing out of this research is occurring outside of Massachusetts.

Entrepreneurial spin-offs from MIT and the University of Massachusetts have resulted from:

- The ability of university researchers to assist in providing small scale, applied technologies that support process improvements for making existing products rather than the creation of entirely new products.

- Research activities directed toward existing commercial markets rather than the creation of new markets. Businesses have proven willing to come to researchers with their technology problems if the researchers:

  - Have some successes,
  - Are visible,
  - Have an outreach program,
  - Are linked with universities,
  - Are linked with trade associations and professional groups.

- Commercial astuteness of these universities, as demonstrated by:

  - Making business agreements rapidly,
  - Allowing faculty to leave to start their own businesses,
  - Using a "rifle shot approach" of providing commercial support only for the most promising university research based on:
    - What is most innovative and worthwhile.

- What is most timely in terms of the market.
- Having specialists on their staff who understand both specific technologies and the markets for those technologies.

LESSONS:
- Commercial research does not necessarily lead to manufacturing activity.
- Regions undergoing economic restructuring cannot save the old jobs, and the level of uncertainty around what kind of new jobs will emerge is high.

Philadelphia

The University City Science Center and its affiliated programs in Philadelphia have a comprehensive and robust technology commercialization program. It began in the mid 1960's with one old building and grew through trial and error into a comprehensive support program for high tech entrepreneurs that provides office and laboratory space, grants, business counseling, venture capital, peer support, and university research affiliations. The Center has a $12 million annual budget (including grants it manages), a staff of 125 people, 150 tenant businesses employing 6,000 people, and 17 acres of land which is approximately two-thirds developed.

The Center has two main thrusts:

- Developing the research park
- Managing technology related programs

It is affiliated with the six medical schools in Philadelphia, providing space and an administrative framework for faculty use in seeking grants. These universities comprise the governing board of the Center. The vitality of the center results from its close working relationship with the Philadelphia Industrial Development Corporation and the Ben Franklin Technology Center (which is a tenant). The Corporation has issued $60 million in loans, developed 1,500 acres of business parks and is a major player in arranging funding packages for manufacturing businesses. The Ben Franklin program provides seed grants averaging $70,000 a year over two years for about 90 projects a year. It is one of five such centers in Pennsylvania that are supported by a $25 million annual State allocation. They conduct extensive reviews of applicants to determine whether they should receive grants. The final decision is made by a board made up of equal numbers of business and science representatives. Grants are repaid through a 3% royalty on future sales, with a cap on total royalties. They claim to create one full time job for every $15,000 the State invests.

Philadelphia, and other cities with strong programs, have deeply rooted, long term organizational alliances between government, industry and universities that enable them to

work with a common will to change the community. The stages in developing these alliances were:

- Learning how to get along together.
- Deciding how to share intellectual property.
- Cooperating around a common interest in sharing information.

The program representatives described themselves as part of a service program designed to build the entrepreneurial spirit in the technological community. The service components include:

- A place to go (incubators and subsequently office space)
- A seed fund
- An infrastructure of supportive professionals who offer *pro bono* services during the start up phase, including help with:
    - venture capital
    - legal issues
    - accounting
    - business management
- University Linkages

LESSONS:

- Assets are needed to leverage the program during its start up phase. In Philadelphia this was found in a university that was willing to act as an economic development engine and in 17 acres of land that were provided by the City.
- A lasting alliance of business, government and universities is important for creating an effective support program for high tech entrepreneurs. This alliance needs to be durable enough to hold together for the six to eight years it takes before significant economic growth is produced.
- An effective technology commercialization program entails much more than real estate development. It is best viewed as a service activity.
- While support is needed from large businesses, it is much easier for programs to have an impact on small businesses and they are more receptive to assistance.

Pittsburgh

Pittsburgh's industrial restructuring began in the 1940's with the formation of the Allegheny Conference, which brought together major manufacturers to eliminate the use of coal

(which was creating severe air pollution) and plan flood control projects and downtown redevelopment. In the 1950's Pittsburgh had a population of 600,000. Today the population is 400,000. The most recent damage to the economy came in 1985 when the steel mills closed permanently in response to a protracted labor strike. Of those who lost their jobs:

- 1/4 left the region
- 1/4 retrained and went on to new jobs
- 1/4 retired
- 1/4 went into much lower paying jobs

Through its job training program the County responded by offering free community college education and a stipend to laid-off workers for as long as it took for them to obtain an Associate Degree. Of the 95,000 jobless steel workers, 7,500 took advantage of this offer.

The core group in Pittsburgh that formed the Allegheny Conference were leaders of five major businesses who were committed to Pittsburgh as the place they wanted to live and do business. This kind of core commitment is necessary because it is hard to attract or retain businesses when there is an exodus of firms from the region and a general absence of firms committed to doing business there.

Economic development in Pittsburgh is focused on small businesses. This is based on the assessment that there are three options for economic development:

- Keep what you have
- Attract new ones
- Grow new ones locally

Each option is easier to carry out with small businesses. Assistance to small businesses also makes it possible to diversify your risks and increases the likelihood of getting some winners.

The two major areas of economic development activity are technical assistance to help manufacturing firms modernize their equipment and procedures, and the Ben Franklin program.

Los Angeles should take note of Pittsburgh's Penn Southwest Association, which maintains an industry recruitment office in Reseda, California. They report that they are finding many businesses that have lost confidence in California. In addition to difficulties caused

by the aerospace "meltdown," the primary reasons reported for why businesses want to leave Los Angeles are:

- Air quality regulations

- Political instability

The view of the Association is that three things impact on business decisions about where to locate:

- Economics - which the firm can deal with through its business decisions.

- Technology - which the firm can acquire through R & D or trade associations.

- Political Environment - over which the firm has almost no control.

Penn Southwest Association reports that uncertainty about the political stability of California in terms of the economic environment and air quality regulations is paramount in the minds of business leaders they meet. It should also be noted, however, that there were no reports of Los Angeles firms that have actually relocated to Pittsburgh.

LESSONS:

- The job training system in Pittsburgh took a much more aggressive role in rebuilding the work force that has been the case in Los Angeles. We should pay attention to programs that enable workers to get AA degrees.

- Technology commercialization programs require active, long term leadership from business leaders who care about the region and have a fundamental commitment to continuing to do business there.

Cleveland

Cleveland has a large concentration of manufacturers in metal fabrication. They face difficulties because of pending cutbacks in commercial aircraft production and because of outdated manufacturing facilities. In response to these challenges, three programs have been developed to revitalize this industry. Their efforts appear to be producing results.

CAMP (Cleveland Advanced Manufacturing Program) is a program supported by both private industry and the State of Ohio. The CAMP training center addresses the above problems through:

- Generic industry research

- Company directed research

- Industry education

Their member firms include small companies as well as large manufacturers such as Reliance Electric. In discussing how to build membership for organizations such as theirs, they commented that everybody will join at the outset, especially if they see their competitors there, but they won't stay more than three years if they don't receive substantive benefits.

Cleveland Tomorrow, which represents the business community, offers an articulate vision of how to bring government, business and universities together to deal with economic restructuring that is causing fundamental regional changes. Their approach was to leverage the resources they had to create linkages between industry, academia and government. In their view this produces a fundamentally necessary alliance as well as a "cultural backdraft" into each sector which makes them more capable of responding to regional needs.

The Ohio Aerospace Institute is a newly formed organization created to support aerospace through a university facility operated in conjunction with two federal laboratories. The $7.2 million budget is made up of $0.5 million from industry, $1.3 million from the State, and the balance from NASA. Its prospects for future funding seem precarious, and its management appeared wary of the prospect of competition from Southern California.

LESSONS:

- The aerospace industry has grown as the result of a very effective partnership between government, industry and academia. Perhaps the question for Los Angeles is how to reshape this partnership.
- Large scale institutes that do not have strong industry support and a solid reason for existence are precarious.
- Know the region's core strengths and build on them.

RECOMMENDATIONS

Leadership Requirements

1. Los Angeles County should take a leadership role in building a broadly shared consensus about the core strengths of the region's advanced technology sector. This effort should be the cornerstone of an alliance between government, industries and universities.

2. A core group of industry leaders who have a personal and corporate commitment to Los Angeles as the place where they want to do business should be enlisted to participate in building this consensus. These leaders should represent the full spectrum of Los Angeles County industry in the alliance.

3. The three major research universities of the region, the California Institute of Technology, the University of California at Los Angeles and the University of Southern California, should be core members of this effort to build an industrial development program. They have essential skills for assisting the public sector in making choices about complex technological issues related to economic development in the advanced technology industry sector. They also have the experience and expertise in relevant technologies and public benefit orientation to help the region obtain research resources and make decisions about the most meritorious use of those resources.

Building on Core Strengths

4. The County should take further steps to identify and consolidate assets that can be used to leverage technology transfer programs. One possible asset might be surplus federally owned manufacturing facilities in Los Angeles County. Any facility development programs should be predicated upon:

   - Significant private sector investments.
   - A good match between the facility and the locational and manufacturing requirements of the product to be made.
   - A good match between the product to be made and the core strengths of the region.
   - A reliable, long-term market for the proposed product.

5. The County should support a policy analysis program to provide strategic data for guiding industrial development and integrating and coordinating public sector decision making and regulatory activity.

6. Reshape the existing, defense-based alliance of the federal government, industry and universities to incorporate local government as a key player in supporting competition in commercial markets. One means of reshaping this alliance in Los Angeles County would be to develop a forum through which high technology industry groups maintain an ongoing dialogue with government to make their needs known and to develop collaborative strategies that support both industry growth and achievement of public goals.

7. Create an organization that will enable university faculty to provide small-scale, applied research assistance for firms seeking to improve products or manufacturing processes, and opens university facilities for testing and prototype development.

8. Support initiatives to encourage interfirm linkages for technology development by promoting increased communication and collaboration around technologies that are pivotal for the growth of high technology industries in the County. One mechanism for achieving this might be conferences on such topics as electric vehicle technology,

fuel cells and advanced battery technology that draw together a broad crossection of leading academic and industry researchers in the region. In addition to providing a clearinghouse for technical information such conferences should offer clear evidence of long term public sector support for the commercialization of these technologies.

Investment Strategies

9. Avoid investing industrial development resources in attempting to replicate the work force and production requirements of declining industries such as aerospace or automotive manufacturing; this would make them social welfare programs rather than economic development programs. The focus should be on new technologies and strong markets.

10. Create an organization with expert staff and a highly focused mission to provide financial and technical assistance for qualified small businesses in high technology fields. This is a complex, difficult task which will require the full attention of a highly competent organization which has this as its sole mission. This task should include bringing together the extraordinarily rich array of entrepreneurial support services that exists in Los Angeles to create a mutually beneficial network that provides a hospitable and nurturing support system for start-up high tech businesses.

11. Make diversified investments to commercialize Los Angeles County's technology resources. In terms of long term planning, small businesses should be the first priority. However, if Los Angeles is going to make a significant impact on reemploying aerospace workers in the near future it will have to be done through large firms, or medium size firms with strong financing and the ability to grow quickly. Therefore, if large assets, strong markets and substantial industry commitments can be assembled, then programs for large businesses should be given equal consideration.

12. Develop financial assistance programs that are goal driven, commercially realistic, have long term promise, and spread over several different industries in order to reduce risk. Loan programs that have strict evaluation standards and are centered around public benefit issues such as encouraging entrepreneurship, establishing Los Angeles County as a strong presence in an emerging industry, assisting growing small businesses, or fostering advanced technology development are more likely to pay off in the short and long term. Avoid developing loan programs that are without specific goals, dedicated to a particular industry, or invest significantly in just a few firms.

Technology Commercialization Strategies

13. A large share of the region's technological assets are resident in the engineering staff of aerospace firms that are downsizing. A technology spin-off program should

be developed which encourages engineers to use unexploited intellectual property to start new businesses. Based on the Philadelphia model, the parent companies could retain a ten to twenty percent interest in the new businesses. This program would help large firms downsize, provide a low risk approach to industrial diversification, and create a seed bed for entrepreneurship.

14. Explore the possibility of developing new technologies, or bidding on government programs, through industrial clusters of state-of-the-art subcontractors who have lower overhead than prime contractors. This might be linked with adaptive reuse of vacant defense facilities.

15. Make marketing assistance available to high technology businesses in Los Angeles County. Other regions of the United States are trying to improve their technology so that they will be more competitive in existing markets. The problem is reversed for many of the larger high technology manufacturers in Los Angeles. What they need is technical assistance with marketing rather than technology. Many aerospace firms have state-of-the-art technologies but they do not know how to deal with any market other than the Department of Defense.

Chapter 6

COMMUNITY AND WORK FORCE IMPACTS OF AEROSPACE UNEMPLOYMENT

1991 Los Angeles County

by Daniel Flaming

SUMMARY OF FINDINGS

- **From 1988 to 1991 the pool of job seekers in Los Angeles County registered with Employment Development Department increased by 31%, and the proportion of this pool made up of people from aerospace increased by 360%.**

- **Between 1988 and 1991 the share of unemployed aerospace workers made up of 31-44 year olds increased by 86% as lay-offs reached deeper into the seniority ranks.**

- **Aerospace lay-offs are cutting proportionately across all occupational groups: Managers 7%, Professional and Technical 38%, Clerical 14%, Production 38%.**

- **Minorities make up 53% of laid-off aerospace workers.**

- **Throughout 1990 a weekly average of 6,813 unemployed aerospace and high tech workers in Los Angeles County were receiving Unemployment Insurance.**

- **In 1991 2,000 high tech jobs were lost each month, with an aggregate loss of 54,200 jobs since 1988.**

OVERVIEW OF ISSUES

Defense lay-offs pose a long-term threat to the strength and well being of Los Angeles County's economy as a steadily growing number of laid-off aerospace workers fail to find any job at all, much less a job as skilled and productive as that which they lost.

- Workers are being displaced and jobs eliminated in the upper end of a labor market that is increasingly polarized between low-skill, low-pay, labor-intensive, high-turnover jobs at one extreme and high-skill, high-pay, high-productivity, stable jobs at the other extreme.

- The quality of the work force is a key factor in determining the course of the regional economy. The disappearance of jobs and workers from the more skilled

and productive sector of the labor force reduces regional competitiveness for attracting skilled manufacturing and related producer service industries.

- Skilled workers being laid off by defense employers represent an asset which will be lost to the region unless the skills of these individuals can be transferred to new and comparably productive jobs.

The fundamental impact of defense cutbacks is that some of the region's most productive workers have lost the opportunity to contribute to the economy, and are instead becoming dependent on the public sector for income maintenance. There is an imperative public interest in reemploying these workers. The region may not be able to prevent decline in its most important manufacturing industry, aerospace, but it must salvage the social investment and the economic productivity linked to the skills of that industry's workers.

This chapter provides information about the locations, skills and characteristics of these workers to help guide public sector reemployment programs as well as efforts to mitigate economic decline in communities where unemployment is concentrated. Lay-offs from defense cutbacks are projected to cause the greatest job losses in 1993 and to continue thereafter.[1] Therefore, public officials in Los Angeles County need information which will help them recognize these economic dislocations as a dynamic, continuing process and understand the basic characteristics and needs of the aerospace workers who are losing their jobs. To provide this kind of dynamic understanding of aerospace job loss, information from three points in time is presented in this chapter. A baseline description is developed based on a report prepared for the Economic Roundtable by a team of USC geographers using the Public Use Microdata Sample from the 1980 Census, which is the most recent comprehensive data base.[2] This description is augmented with information from 1988 Unemployment Insurance applications of unemployed aerospace workers, when the work force was beginning to shrink, as well as 1991 Unemployment Insurance applications, which is the most recent data available.

COMMUNITY IMPACTS

Defense Dependent Communities

Loss of defense jobs will have a particularly intense impact on Los Angeles County because 86% of the County's aerospace work force lives within the County, as compared to a 68%

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[1]Conrad Peter Schmidt and Steven Kosiak, Potential Impact of Defense Spending Reductions on the Defense Labor Force by State, (Washington, DC: Defense budget Project, August 1991).

[2]Jennifer R. Wolch, Robin Law and Lois Takahashi, "Defense industries, Workers and Communities in Los Angeles County," September 1990. This research report was prepared for the Economic Roundtable making extensive use of the Public Use Microdata Sample (PUMS) from the 1980 Census. The 1990 PUMS data is expected to be available in 1993, and it will be possible to update these findings at that time.

residency level for the total County work force.[3] This means that dislocations from defense layoffs, such as loss of income and attenuation of workers' place within the fabric of their communities, will be concentrated much more within Los Angeles County than would be the case with other industries which employ more workers from adjacent counties.

Using 1980 PUMS data it is possible to identify characteristics of workers at major defense prime contractor sites. This analysis shows that within Los Angeles County the impact of the defense industry is further concentrated in three major zones in which over 20% of the residents work for defense related firms.[4] These zones, which are in the North County, the San Fernando Valley, and the South Bay, are especially vulnerable to defense dislocations. The presence of concentrations of defense workers in the three defense dependent zones identified through PUMS data is consistent with information provided by Michael Beltramo in Chapter 2, identifying the areas within the County receiving the most defense funds.[5] Six of the eight sub-County areas receiving the greatest amounts of defense funds are in defense dependent zones. There is a close interrelationship between the job location and residential location of aerospace workers. Twenty-seven percent of aerospace workers live within 5 miles of their job site and an additional 54% live within 10 miles of their job site.[6] Figure 1 is a map showing the location of the three defense dependent zones.

Communities within the three defense dependent zones can be divided into higher and lower income clusters. The incomes of defense workers provide economic underpinnings for the quality of life in both clusters of defense dependent communities. One group of communities including Chatsworth, Hermosa Beach, Manhattan Beach, Redondo Beach, and the Palos Verdes peninsula, is the more affluent based on the higher earnings of professional and highly skilled defense workers. Aerospace layoffs will damage these communities, but are unlikely to cause them to drop through the floor of the economy.

The other group of communities including Burbank, Pacoima, Sepulveda, Panorama City, Lawndale, Lomita, and Gardena, is less affluent with concentrations of workers at the lower end of the income and skill spectrum within the defense industry. For this latter group, defense jobs have provided a window of opportunity for entering the regional economic mainstream. The loss of their blue collar jobs may be a precursor to community destabilization in ways similar to that in which the closures of General Motors, Bethlehem Steel, and Firestone altered the communities where they were located.

The employment base within the three defense dependent zones is concentrated in the durable manufacturing sector, which is dominated by the defense industry. This means that

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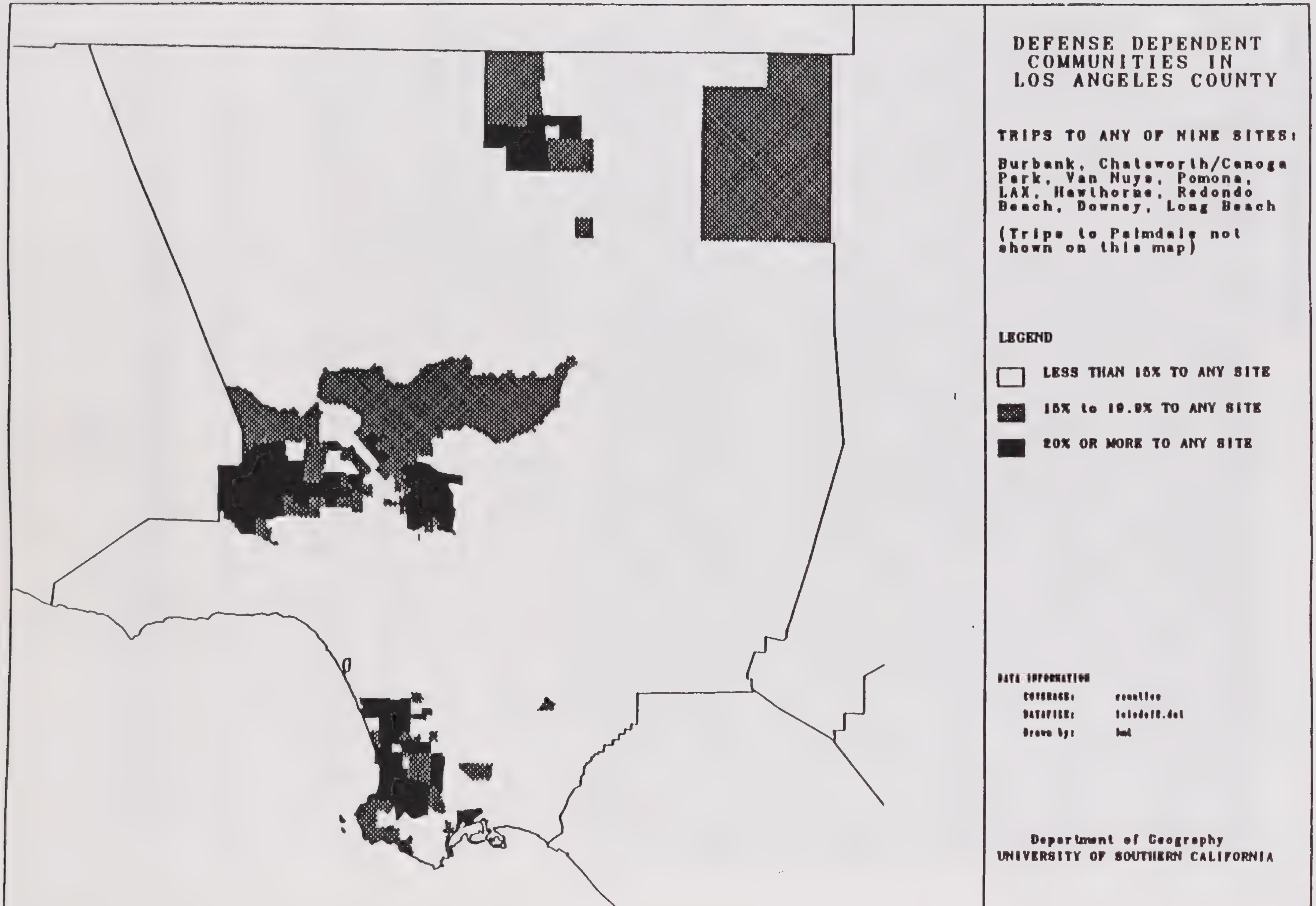
[3]Ibid, Table 6.3.

[4]Ibid, pp. 27-29.

[5]Michael Beltramo, "Defense Contracting and the Los Angeles County Economy," Chapter 2, p. 8, of this report.

[6]Wolch, Law, Takahashi, op.cit., Table 6.4.

Figure 1



DEFENSE DEPENDENT COMMUNITIES IN LOS ANGELES COUNTY
TRIPS TO ANY OF NINE SITES:
Burbank, Chatsworth/Canoga Park, Van Nuys, Pomona, LAX, Hawthorne, Redondo Beach, Downey, Long Beach
(Trips to Palmdale not shown on this map)
LEGEND
LESS THAN 15% TO ANY SITE
15% to 19.9% TO ANY SITE
20% OR MORE TO ANY SITE
Department of Geography
UNIVERSITY OF SOUTHERN CALIFORNIA

residents of these communities have few opportunities in their geographic area for jobs in other industries. Furthermore, these communities are job-poor compared to the rest of the County. They have a jobs per resident ratio that is only slightly more than half that of the County overall.[7] Because of the concentrated impact of the defense industry on residents of these communities and the scarcity of alternative employment opportunities, these communities are vulnerable to significant economic and social dislocations as the result of defense layoffs.

Communities Impacted by Aerospace Unemployment

A current and more detailed picture of the communities in which unemployed workers are seeking help, the age, gender and ethnicity of these workers, and their occupations can be obtained using information from applications for Unemployment Insurance benefits filed between July 1, 1990 and June 30, 1991. The patterns of aerospace unemployment shown by this data are similar to that shown by the 1980 PUMS data, with the addition of several communities that have been impacted by cutbacks in firms that are second and third tier aerospace subcontractors. Local offices of the Employment Development Department (EDD) are ranked by their share of the County's aerospace unemployment in Table 1, which summarizes a portion of the data contained in Table 7.[8] Based on this data, the Lancaster office, serving the North County, accounts for 10% of the County's aerospace unemployment, and aerospace workers make up 15% of Unemployment Insurance claimants in that area.[9] Offices serving the San Fernando Valley (Canoga Park, North Hollywood, Glendale, San Fernando) account for 29% of aerospace unemployment, and aerospace workers make up from 9% to 15% of the unemployed in those communities. In the South Bay, Torrance and Inglewood account for 10% of aerospace unemployment, and aerospace workers make up from 9% to 12% of the unemployed workers. It is noteworthy that 7% of the County's aerospace unemployment is in East Los Angeles and Lincoln Heights, although given other sources of job loss, these workers make up only 6% of all unemployed workers in those communities. These workers appear to be part of a recent increase in the number of minority aerospace workers, but these gains are being lost in the flood of aerospace unemployment. The San Gabriel Valley communities of West Covina, Pomona and El Monte account for 14% of the County's aerospace unemployment, and aerospace workers make up from 9% to 12% of the unemployed. Cutbacks at the General Dynamics plant in Pomona would account for Pomona's unemployment and some

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[7] Ibid, pp. 31-32.

[8] Table 7 uses the actual count of Unemployment Insurance claimants in seven occupations that are specific to aerospace, and which account for 34% of aerospace employment, to track the community distribution, characteristics, and changes between 1988 and 1991 of workers displaced from aerospace. The seven occupations used for this analysis were selected because they are industry-specific, representative of the professional, machinist, component and structural occupations found in aerospace, and large enough to yield a sample of unemployed workers in most communities in both 1988 and 1991.

[9] Unemployed workers may apply for Unemployment Insurance at any EDD office, so the community in which an application is filed is not necessarily the community of residence. But Table 7 shows applications dispersed throughout the County in a pattern similar to that of aerospace residential concentrations shown by PUMS data, which suggests that many workers file applications near their homes rather than their former places of work.

TABLE 1

AEROSPACE SHARE OF COMMUNITY UNEMPLOYMENT
Los Angeles County 1991

Community	Percent of Total 1991 Los Angeles County Aerospace Unemployment	Aerospace Share of Community Unemployment in 1991
CANOGA PARK	10%	15%
LANCASTER	10%	14%
NO. HOLLYWOOD	8%	11%
GLENDALE	7%	9%
TORRANCE	6%	11%
EAST L.A.	6%	6%
WEST COVINA	5%	12%
POMONA	5%	10%
SAN FERNANDO	4%	11%
WHITTIER	4%	10%
INGLEWOOD	4%	9%
EL MONTE	4%	8%
LAKEWOOD	3%	10%
PASADENA	3%	8%
LONG BEACH	3%	7%
CARSON	2%	7%
COMPTON	2%	7%
NORWALK	2%	6%
SOUTH GATE	2%	5%
WEST L.A.	2%	5%
S.CENTRAL L.A.	2%	4%
HOLLYWOOD	2%	4%
AVALON	2%	3%
LINCOLN HGHTS	1%	7%
L.A. CENTRAL	1%	2%
SANTA MONICA	0.3%	4%
COMBINED TOTAL	100%	8%

Source: Employment Development Department Local Area Office B96 Reports for 1991.

of West Covina's. Aerospace unemployment in El Monte, and to some extent West Covina, reflects cutbacks in second and third tier electronics firms, with unemployment in electronics occupations having increased by a factor of as much as thirty since 1988 (Table 7).

The number of aerospace unemployment insurance claimants increased approximately four-fold between the early stage of defense cutbacks in 1988 and the large-scale cutbacks of 1991. During this three year interval the number of Unemployment Insurance claimants in Los Angeles County increased 31%, and Table 2 shows that the share of this pool of claimants made up of aerospace workers increased by approximately three-fold.[10] The communities where change was the most dramatic were North Hollywood, Canoga Park and Glendale, which had the greatest absolute increases in the number of unemployed aerospace workers, and East Los Angeles-Lincoln Heights, West Covina and El Monte, which had the greatest percentage increases in aerospace unemployment as well as large numerical increases. The communities which had the most unemployed aerospace workers were Lancaster, Canoga Park and North Hollywood.

During 1991 Los Angeles County lost nearly 2,000 high tech jobs each month, with an aggregate loss of 58,500 jobs since 1988.[11] This is a marked increase over the 900 jobs lost per month in 1989 and 1990. Figure 2 shows the accelerating rate of job loss in the total high tech industry group, as well as the largest of its seven component indus-tries, aircraft and parts.[12] The result of this job loss is not only a reduction in productivity but an increase in social dependency. During 1990 there was a weekly average of 6,813 unemployed workers from aerospace industries receiving Unemployment Insurance in Los Angeles County.[13] This represents only those workers eligible for unemployment insurance who had not found another job or exhausted their eligibility after receiving benefits for 6 months. It is not possible within the scope of this investigation to determine how many of the fifty-thousand aerospace workers who lost their jobs are still unemployed

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[10]Change in the proportion of total unemployment caused by aerospace unemployment is indicated by the Change Factor. In Table 2, based on changes in unemployment from the seven aerospace occupations used to track unemployment changes at a community level, the Change Factor is 2.77. Changes in unemployment for a more comprehensive list of aerospace occupations are shown in Table 5, and the Change Factor for the total group of aerospace-specific occupations is 3.6.

[11]The Southern Area Information Group of the Employment Development Department's Labor Market Information Division breaks out industry employment data for a group of "high tech" industries comprised primarily of the aerospace sector. Annual average employment levels in Los Angeles County's high tech industry group have been: 281,100 in 1988, 272,400 in 1989, 259,600 in 1990, and 234,000 in 1991. As of December 1991, the latest date for which employment data is available, high tech employment had declined to 225,600. During the 12 month period from December 1990 to December 1991, employment decreased by 23,300 for an average monthly loss of 1,942 jobs.

[12]The seven industries that comprise the high tech group and their employment in Los Angeles County as of December 1991 are as follows: Computer and Office Equipment 10,000; Communications Equipment 5,000; Electronic Components and Accessories 24,200; Aircraft and Parts 109,100; Guided Missiles and Space Vehicles 11,600; Search and Navigation Equipment 59,700; Measuring and Controlling Devices 12,900. This data is from the Labor Market Information Division of the Employment Development Department.

[13]Employment Development Department, Report 96A: "Unemployment Insurance Weeks Compensation by Industry," February 28, 1991.

TABLE 2

CHANGES IN AEROSPACE UNEMPLOYMENT WITHIN LOS ANGELES COUNTY: 1988 AND 1991

EDD DISTRICT	1988 Total District Unemp.	1988 Unemp. 7 Aero. Occup.	% 1988 District Unemp.	1991 Total District Unemp.	1991 Unemp. 7 Aero. Occup.	% 1991 District Unemp.	1988–91 Change 7 Aero. Occup.	% Change 1988–91 7 Aero. Occup.	Change Factor (Change in Aero. Share of District Unemp)
AVALON	11181	89	0.8%	12543	145	1.2%	56	163%	1.45
CANOGA PARK	14979	206	1.4%	16312	796	4.9%	590	386%	3.55
CARSON	5704	37	0.6%	6695	152	2.3%	115	411%	3.50
COMPTON	6506	62	1.0%	8492	207	2.4%	145	334%	2.56
EAST L.A.	13824	66	0.5%	23187	474	2.0%	408	718%	4.28
EL MONTE	10799	17	0.2%	13580	350	2.6%	333	2059%	16.37
GLENDALE	7012	33	0.5%	18269	565	3.1%	532	1712%	6.57
HOLLYWOOD	8226	44	0.5%	10970	133	1.2%	89	302%	2.27
INGLEWOOD	9869	204	2.1%	10391	305	2.9%	101	150%	1.42
LAKEWOOD	5177	139	2.7%	7315	249	3.4%	110	179%	1.27
LANCASTER	16856	470	2.8%	18315	845	4.6%	375	180%	1.65
LINCOLN HGHTS	2402	2	0.1%	2514	62	2.5%	60	3100%	29.62
LONG BEACH	9064	32	0.4%	10651	251	2.4%	219	784%	6.68
L.A. CENTRAL	7886	20	0.3%	12161	96	0.8%	76	480%	3.11
NO. HOLLYWOOD	10232	59	0.6%	18188	655	3.6%	596	1110%	6.25
NORWALK	5767	9	0.2%	8665	179	2.1%	170	1989%	13.24
PASADENA	6008	22	0.4%	9789	251	2.6%	229	1141%	7.00
POMONA	9804	124	1.3%	11408	391	3.4%	267	315%	2.71
SAN FERNANDO	2260	47	2.1%	9169	347	3.8%	300	738%	1.82
SANTA MONICA	763	15	2.0%	1973	28	1.4%	13	187%	0.72
S.CENTRAL L.A.	11726	17	0.1%	13912	187	1.3%	170	1100%	9.27
SOUTH GATE	10425	24	0.2%	9313	153	1.6%	129	638%	7.14
TORRANCE	17343	340	2.0%	14336	515	3.6%	175	151%	1.83
WEST COVINA	11809	21	0.2%	11256	433	3.8%	412	2062%	21.63
WEST L.A.	4027	36	0.9%	11743	179	1.5%	143	497%	1.71
WHITTIER	11194	159	1.4%	10188	346	3.4%	187	218%	2.39
COMBINED TOTAL	230843	2294	1.0%	301335	8294	2.8%	6000		

Source: Employment Development Department Local Area Office B96 Reports for 1988 and 1991.

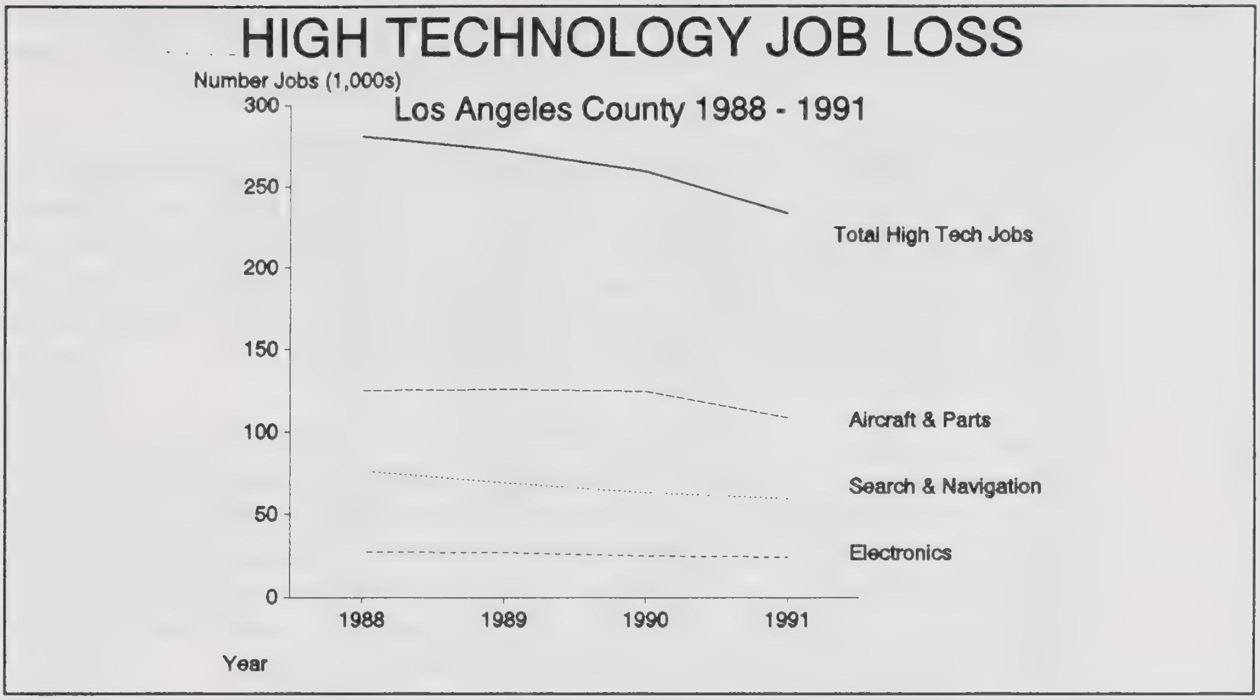

Figure 2

or how many are marginally employed in part time or unskilled jobs. It is clear, however, that the economy has not absorbed a significant share of these workers, and that there is a steadily growing pool of unutilized and under-utilized high tech workers in Los Angeles County.

WORKFORCE IMPACTS

Characteristics of the Aerospace Work Force

The following composite profile is a rough description which encompasses a majority of defense employees, and offers a point of departure for considering the retraining needs of different groups within the defense work force.

> The typical defense worker is a thirty-eight-year-old, male homeowner who has been a long-term resident of the community, who probably has a college degree and is married to a spouse who also works, who commutes thirteen miles to a job as a skilled production worker, professional specialist, or manager and earns 10% to 20% more than counterparts in the same occupation in other industries.[14]

[14]Wolch, Law and Takahashi, loc.cit., pp. 11-24.

Based on this profile there are at least three distinctive characteristics that set defense workers apart from most other workers in Los Angeles County and should be taken into consideration in designing reemployment programs for laid-off workers.

1. Defense workers have unusually strong ties to their communities because of length of residence, home ownership, and jobs of spouses and children. These factors make relocation difficult for defense workers and increase the likelihood that they will have to cope with personal and financial crises after the loss of their jobs. An effective network of supportive services is needed to assist these workers in keeping their households together as they seek new employment.

2. Defense workers are more highly skilled and educated than most other groups of displaced workers. As a result they will need longer retraining to become qualified for a new occupation with a skill level that is equivalent to their old occupation. It should also be kept in mind that these workers have abilities for problem solving that may enable them to contribute solutions to overcoming barriers to their own reemployment. Training programs for these workers should be long-term and flexible in adapting to worker-initiated reemployment plans.

3. Defense workers are separated from the mainstream of the labor market by the 10% to 20% pay differential they have received, their specialized, industry-specific skills, and their enculturation to the work environment of a unique, quasi-nationalized industry. This difference means that laid-off defense workers face a difficult transition in adjusting to the mainstream labor market as well as in overcoming the bias of other employers against workers with backgrounds in defense jobs.

Characteristics of Unemployed Aerospace Workers

Aerospace workers laid-off in 1991 are substantially representative of the overall profile of the industry work force: 39% were women, 49% were between 31 and 44 years old, and 53% were minority (Table 3). Of the 43 occupations shown in Table 3,[15] women had most frequently lost jobs as electronics assembler, small parts assembler, and production assembler. Minority workers had most frequently lost jobs as machinists, sheet metalworkers, assemblers, and electronics mechanics. There is a pattern of upward career mobility as workers grow older. Of industry-specific occupations (as opposed to generic occupations such as secretary or computer operator), the greatest occupational concentration of unemployed 22 to 30 year olds is in assembly, the greatest concentration of 31 to 44 year olds is in drafting, and the greatest concentration of workers over 45 years old is found in engineering. Older workers losing their jobs because of defense cutbacks are losing not only a job but a career effort to climb the aerospace job ladder. Changes in

[15]Table 3 uses Dictionary of Occupational Titles (DOT) code occupational classifications, in contrast to Occupational Employment Statistics (OES) code occupational classifications which are used in the next chapter. DOT codes are more specific than OES codes, which represent groups of DOT codes. Because different data sources use different occupational classification systems it is necessary to move back and forth between the two sets of codes.

TABLE 3

CHARACTERISTICS OF UNEMPLOYED AEROSPACE WORKERS
LOS ANGELES COUNTY 1991

Title	Total '91	% Female	% 22–30 Yrs	%31–44 Yrs	%45+ Yrs	% Minority
Accounting Clerk	4408	69%	28%	50%	21%	58%
Arcft.Mechanic	395	4%	28%	53%	18%	39%
Assembler, Prec	72	0%	24%	48%	29%	52%
Assembler, Mach	239	38%	18%	65%	17%	85%
Assembler, Sml. Pt.	836	62%	20%	58%	22%	86%
Assembler, Prod.	1650	50%	25%	55%	20%	86%
Assembler, Elec.	1864	56%	25%	52%	23%	80%
Assembler, Arcft.	978	10%	16%	55%	29%	32%
Asmblr, Metal Fab.	74	17%	29%	46%	25%	46%
Asmb, Arcft Elec.	123	24%	16%	49%	35%	26%
Computer Operator	1560	36%	31%	59%	10%	68%
Computer Programmer	195	27%	25%	54%	21%	40%
Drafter Aeronautical	21	25%	25%	25%	50%	50%
Drafter Electrical	73	13%	4%	74%	22%	39%
Drafter Electronic	102	16%	10%	54%	36%	46%
Drafter Engineering	83	12%	16%	40%	44%	52%
Drafter Mechanical	279	6%	16%	54%	30%	54%
Electron. Repairer	290	12%	19%	58%	23%	65%
Electron. Mechan	1091	3%	28%	57%	15%	61%
Engineer Aeronautical	64	18%	18%	35%	47%	29%
Engineer Aero.Design	143	7%	10%	17%	73%	40%
Engineer Electrical	328	9%	20%	45%	34%	47%
Engineer Electronic	381	5%	12%	42%	46%	29%
Engineer Mechanical	413	4%	12%	40%	48%	30%
Engineer Industrial	178	9%	15%	41%	43%	43%
General Secretary	4579	97%	47%	30%	23%	28%
Gen.Office Clerk	1994	8%	30%	48%	21%	50%
Machinist	2377	3%	18%	57%	25%	60%
Manager Ind.Prod	175	7%	12%	38%	50%	40%
Manager R & D	24	13%	0%	50%	50%	0%
Num.Control Oper	250	6%	19%	67%	14%	51%
Oper.Rsch.Anlyst	20	40%	0%	40%	60%	40%
Prec. Inspector	32	8%	0%	38%	62%	62%
Plng.Exped.Clerk	319	37%	30%	44%	26%	48%
Production Insp.	165	8%	4%	46%	50%	21%
Purchasing Agent	576	26%	14%	42%	44%	35%
Sheet Met.Worker	406	21%	27%	59%	14%	89%
Stock Clerk	3193	18%	28%	61%	10%	76%
Systems Analyst	248	30%	14%	55%	30%	29%
Technician Eltri	88	6%	26%	60%	14%	51%
Technician Eltro	981	4%	24%	54%	22%	42%
Technician Mechanical	83	17%	19%	42%	39%	50%
Technical Writer	182	28%	7%	45%	48%	9%
TOTAL	31532	39%	28%	49%	23%	53%

Source: Employment Development Department B96 Metropolitan Statistical Area report for 1991.

the composition of laid-off aerospace workers can be seen in Table 4, which shows characteristics of unemployed workers from thirteen major aerospace-specific occupations in which there were significant numbers of Unemployment Insurance applicants in both 1988 and 1991. In 1988 unemployed aerospace workers were mostly young, 51% were between 22 and 30 years old. But as lay-offs cut deeper into the work force they began to reach more senior workers, and in 1991 unemployed aerospace workers were mostly 31 to 44 years old. Older workers are more likely to have spouses, children, college tuition, mortgages, and to need employer-sponsored health plans. This means that current aerospace lay-offs are causing dislocations that are both more pervasive in terms of numbers and more disruptive in terms of impacts on workers than those three years ago.A large number of minority workers are losing their jobs because of aerospace lay-offs. The 1980 PUMS data showed that at that time 25% of the aerospace work force was minority.[16] In 1988, 45% of unemployed aerospace workers were minority, reflecting some of Los Angeles County's demographic changes during the intervening eight years. And in 1991, 53% of unemployed aerospace workers were minority. Given the high percentage of minority workers in current lay-offs it appears that the "last hired, first fired" principal is reversing gains made by minorities in gaining entrance to the aerospace work force, where lay-offs are largely based on worker seniority. The remaining aerospace work force is likely to be preponderantly older, Anglo, male workers.

Occupations and Transferrable Skills of the Aerospace Work Force

The startling increase in aerospace unemployment between 1988 and 1991 can be seen in Table 5. Of the 41 nonclerical aerospace occupations that are listed, just over half (22) do not show a single worker applying for Unemployment Insurance in 1988.[17] The aerospace-specific occupations with the greatest absolute increase in unemployment between 1988 and 1991 were machinist, production assembler and electronics assembler. Assembler occupations in aircraft and electronics showed a 994% increase in unemployment over this three year period. This is the occupational category with the largest number of unemployed workers in aerospace, followed by the professional, technical and managerial group. This latter group, which includes the most highly educated and trained aerospace workers, showed a 446% increase in unemployment. The only aerospace occupation showing a decrease in unemployment was electrician, airplane. This occupation is part of the structural workers group, which had a 239% increase in unemployment, the smallest of any aerospace group. The machinists and mechanics group had a 325% increase in unemployment, and includes machinists which has the largest number of unemployed workers of any aerospace occupation.[18]

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[16]Wolch, Law and Takahashi, op.cit., Table 5.3.

[17]It is not possible to quantify degree of change for occupations that showed no unemployed workers in 1988, so in Table 8 the percent change and change factor for these occupations in which unemployment has increased from a base of zero is shown as "Major."

[18]The actual number of unemployed aerospace workers can only be estimated from available data. The numbers shown in Tables 2,3,4, 5 and 7 are for Unemployment Insurance applicants in a given year. Some workers are not eligible for Unemployment Insurance benefits or do not bother to apply. Other workers, for example in clerical occupations, apply for benefits but find new jobs. And still

TABLE 4

CHANGES IN COMPOSITION OF UNEMPLOYED AEROSPACE WORKERS
LOS ANGELES COUNTY: 1988 AND 1991

DOT Code	Title	Total 1988	Total 1991	1988 % Female	1991 % Female	1988 % 22–30 Years	1991 % 22–30 Years	1988 % 31–44 Years	1991 % 31–44 Years	1988 % 45+ years	1991 % 45+ Years	1988 % Minority	1991 % Minority
003061010	Engineer Electrical	109	328	4%	9%	36%	20%	21%	45%	43%	34%	32%	47%
003161014	Technician Eltro	487	981	5%	4%	49%	24%	33%	54%	18%	22%	36%	42%
003281010	Drafter Electrical	21	73	11%	13%	44%	4%	22%	74%	33%	22%	44%	39%
003281014	Drafter Electronic	21	102	13%	16%	38%	10%	25%	54%	38%	36%	50%	46%
007061014	Engineer Mechanical	75	413	0%	4%	23%	12%	23%	40%	53%	48%	33%	30%
007161026	Technician Mechanical	35	83	0%	17%	40%	19%	40%	42%	20%	39%	33%	50%
600280022	Machinist	690	2377	2%	3%	49%	18%	28%	57%	22%	25%	59%	60%
621281014	Arcft.Mechanic	313	395	1%	4%	58%	28%	28%	53%	14%	18%	22%	39%
726684018	Elec.Asembler	498	1864	60%	56%	44%	25%	34%	52%	22%	23%	74%	80%
806281022	Production Insp.	76	165	9%	8%	48%	4%	17%	46%	35%	50%	26%	21%
806381026	Arcft.Assembler	466	978	6%	10%	51%	16%	28%	55%	21%	29%	33%	32%
825281018	AirCrftElec.Asmb	149	123	0%	24%	69%	16%	18%	49%	13%	35%	21%	26%
828281010	Electron. Mechan	325	1091	7%	3%	63%	28%	28%	57%	9%	15%	55%	61%
	TOTAL	3265	8973	11%	14%	51%	21%	29%	54%	21%	26%	45%	53%

Source: Employment Development Department B96 Metropolitan Statistical Area reports for 1988 and 1991.

TABLE 5

CHANGES IN AEROSPACE UNEMPLOYMENT BY OCCUPATION
LOS ANGELES COUNTY: 1988 AND 1991

DOT Code	Title of Occupation PROF., TECH., MGR.	1988 Unemp.	% 1988 Total	1991 Unemp.	% 1991 Total	1988–91 Change	% Change 1988–91	Change Factor
002061014	Aeronautical Engineer	0	0.00%	64	0.02%	64	Major	Major
002061022	Aeronaut. Design. Engineer	0	0.00%	143	0.05%	143	Major	Major
002261010	Drafter, Aeronautical	0	0.00%	21	0.01%	21	Major	Major
003061010	Electrical Engineer	109	0.05%	328	0.12%	219	301%	2.6
003061030	Electronic Engineer	0	0.00%	381	0.14%	381	Major	Major
003161010	Electrical Technician	0	0.00%	88	0.03%	88	Major	Major
003161014	Electronic Technician	487	0.20%	981	0.35%	494	201%	1.7
003281010	Drafter, Electrical	21	0.01%	73	0.03%	52	348%	2.9
003281014	Drafter, Electronic	21	0.01%	102	0.04%	81	486%	4.1
007061014	Mechanical Engineer	75	0.03%	413	0.15%	338	551%	4.7
007161018	Engineering Asst. Drafter	0	0.00%	83	0.03%	83	Major	Major
007161026	Mechanical Eng. Technician	35	0.01%	83	0.03%	48	237%	2.0
007281010	Drafter, Mechanical	0	0.00%	279	0.10%	279	Major	Major
012167030	Industrial Engineer	0	0.00%	178	0.06%	178	Major	Major
012167042	Manufacturing Engineer	62	0.03%	353	0.13%	291	569%	4.8
012167066	Electroic Data Sys. Analyst	99	0.04%	202	0.07%	103	204%	1.7
020067018	Operations Research Analyst	0	0.00%	20	0.01%	20	Major	Major
020187010	Computer Programmer	0	0.00%	195	0.07%	195	Major	Major
131267026	Technical Writer	33	0.01%	182	0.06%	149	552%	4.7
161167010	Systems Analyst	0	0.00%	248	0.09%	248	Major	Major
162157038	Purchasing Agent	222	0.09%	576	0.20%	354	259%	2.2
183117014	Manager Industrial Production	0	0.00%	175	0.06%	175	Major	Major
189117014	Manager Research&Development	0	0.00%	24	0.01%	24	Major	Major
Subtotal		1164	0.49%	5192	1.85%	4028	446%	3.8
	CLERICAL							
201362030	General Secretary	1130	0.47%	4579	1.63%	3449	405%	3.4
213362010	Computer Operator	518	0.22%	1560	0.55%	1042	301%	2.6
216482010	Accounting Clerk	1367	0.57%	4408	1.57%	3041	322%	2.7
219362010	General Office Clerk	784	0.33%	1994	0.71%	1210	254%	2.2
221167018	Planning & Expediting Clerk	0	0.00%	319	0.11%	319	Major	Major
222387058	Stock Clerk	590	0.25%	3193	1.14%	2603	541%	4.6
Subtotal		4389	1.84%	16053	5.71%	11664	366%	3.1
	MACHINISTS & MECHANICS							
600280022	Machinist	690	0.29%	2377	0.85%	1687	344%	2.9
601280046	Tool & Die Maker	65	0.03%	99	0.04%	34	152%	1.3
601281022	Precision Inspector	0	0.00%	32	0.01%	32	Major	Major
609662010	Numerical Control Operator	0	0.00%	250	0.09%	250	Major	Major
609685018	Production Machine Operator	139	0.06%	359	0.13%	220	258%	2.2
619685062	Sheet Metal Worker	0	0.00%	406	0.14%	406	Major	Major
621281014	Aircraft Mechanic	313	0.13%	395	0.14%	82	126%	1.1
Subtotal		1207	0.51%	3918	1.39%	2711	325%	2.8
	COMPONENTS WORKERS							
706681010	Precision Assembler	0	0.00%	72	0.03%	72	Major	Major
706684018	Machine Assembler	0	0.00%	239	0.09%	239	Major	Major
706684022	Small Parts Assembler	0	0.00%	836	0.30%	836	Major	Major
706687010	Production Assembler	0	0.00%	1650	0.59%	1650	Major	Major
726281014	Electronics Tester	0	0.00%	290	0.10%	290	Major	Major
726684018	Electronics Assembler	498	0.21%	1864	0.66%	1366	374%	3.2
Subtotal		498	0.21%	4951	1.76%	4453	994%	8.4
	STRUCTURAL WORKERS							
806281022	Production Inspector	76	0.03%	165	0.06%	89	217%	1.8
806381026	Aircraft Assembler	466	0.20%	978	0.35%	512	210%	1.8
809381010	Metal Fabricator & Assembler	0	0.00%	74	0.03%	74	Major	Major
825281018	Electrician, Airplane	149	0.06%	123	0.04%	−26	83%	0.7
828281010	Electronics Mechanic	325	0.14%	1091	0.39%	766	336%	2.8
Subtotal		1016	0.43%	2431	0.86%	1415	239%	2.0
TOTAL		8274	3.47%	32545	11.58%	24271	393%	3.3

Source: Employment Development Department Metropolitan Statistical Area B96 report for 1988 and 1991.

A 393% increase in the level of unemployment between 1988 and 1991 is shown in Table 5, but if clerical occupations are omitted, since they reflect unemployment from many different industries, aerospace unemployment shows a 425% increase in unemployment over these three years. This figure for change in unemployment varies depending upon the group of occupations upon which it is based. Table 5 contains the most comprehensive listing of unemployment data for aerospace occupations that it was possible to assemble, making 425% the most reliable quantification possible of the increase in the annual number of Unemployment Insurance applicants between 1988 and 1991. It should be noted that the total pool of unemployed aerospace workers has increased by a factor much greater than 425% over these three years because the pool includes the cumulative number of workers who have been laid-off in preceding years and not found new jobs.

The severity of increases in aerospace unemployment can be gaged by the proportion of total regional unemployment that is accounted for by unemployed aerospace workers; this is shown as the Change Factor in Table 5.[19] The change factor for assembler occupations was 8.4, the highest of any aerospace occupational group. This reflects a precipitous reversal of circumstances for assemblers, who have limited skills and training yet were in high demand three years ago. The professional, technical, managerial group is at the other extreme from Assemblers in terms of education and training, but it has a change factor of 3.8, which is the second highest of any aerospace group. An overall change factor of 3.3 is shown for aerospace in Table 5. If clerical occupations are omitted from this calculation, since they reflect unemployment from many different industries, the share of County unemployment that is accounted for by unemployed aerospace workers is found to have increased by a factor of 3.6 from 1988 to 1991.

Defense workers can be divided into three groups which each account for roughly a third of the total work force. The first group is skilled or professional workers in generic occupations that are not limited to the defense industry. The second group is in skilled or professional occupations that are specific to the defense industry. And the third group is in low-skilled occupations at the bottom of the industry pay scale. Defense cutbacks arecausing lay-offs in nearly equal proportions of workers in all three groups.[20] An overview of skills and income in the aerospace work force is provided in Table 6.

For workers in the first group, which encompasses generic occupations such as managers, personnel officers at the executive level and bookkeepers and clerical workers at the

[19]The change factor was computed by dividing the percent of total unemployment accounted for by unemployment from a particular occupation or group of occupations in 1988 into the equivalent percentage for 1991. A value greater than unity indicates the particular occupation or group of occupations is accounting for a growing share of County unemployment, and that workers are losing jobs in that occupation at a rate greater than that of the overall increase in County unemployment.

[20]Aerospace Industries Association, "1990-91 Aerospace Industry Employment Survey," July 3, 1991, Table I.

Table 6

SKILLS AND EARNINGS OF DEFENSE OCCUPATIONAL GROUPS

Occupational Group	Percent of Defense Work Force	Minimum Years of Occupational Training	Minimum Education	Earnings Compared to Workers in Other Industries
Managers & Administrators	11.8%	Over 2	High School or College	123%
Professional Specialists (engineers)	17.2%	Over 4	At least College Degree	130%
Technicians	6.7%	Over 2	1-2 Years College	119%
Clerical & Admin. Support (bookkeeping, secretaries, data entry)	17.6%	3 Months to 2 Years	Eighth Grade to High School	124%
Mechanics, Repairers	4.3%	Over 2	High School	107%
Precision Production (machinist)	15.4%	Over 2	High School	108%
Machine Operators, Assemblers	20.2%	*Aircraft* Over 1 Year *Electronics* 1-3 Months	*Aircraft* High School *Electronics* Sixth Grade	122%
All Others	6.8%	n.a.	n.a.	n.a.

Sources: Employment Development Department, Occupational Employment Statistics (OES): Survey Estimates 1986, California; Wolch, Law and Takahashi, op.cit., Table 5.10.

administrative support level, the best reemployment outcome that is realistically likely is a job:

- Secured without going through a significant interval of unemployment
- Located within reasonable commuting distance of the worker's home
- Utilizing skills and knowledge previously acquired
- Paying 80%, or at best 90%, of previous earnings

Even though this group has the most optimistic post-lay off prospects of any defense group, many managers achieved their upward mobility based on abilities for adapting to requirement of the defense industry and lack qualifications required for equivalent positions in other industries. These individuals are likely to go through a long interval of unemployment as they struggle unsuccessfully to retain their former lifestyle. National data indicate that managers and professional specialists go through the longest interval of unemployment before finding new jobs of any occupational group.[21] Supportive services should be made available on a long-term basis to assist those individuals who have difficulty in making a transition to a new job.

The second group of defense workers, such as engineers, technicians, and precision production workers, has skills in specialized production or professional areas that are in little demand outside of the defense industry. The best reemployment outcome that these workers can realistically hope for is a job:

- That builds on existing skills, knowledge, aptitudes and interests, perhaps through a structured training program
- Offering stable employment with opportunities for career advancement
- That is obtained before severance benefits, personal savings, and Unemployment Insurance benefits are exhausted
- Paying a salary which enables the worker to remain in the community where s/he has roots and to retain primary elements, such as home ownership, of his/her previous standard of living

Conventional job training programs which offer short term training and job placement do not meet the needs of this group. These workers need assessment, counseling, and flexible sources of support for meeting their basic needs while they participate in job search or retraining.

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[21] U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, September 1991, p. 25.

The third group is comprised of approximately 30% of the defense work force and has incomes below the County median income.[22] Defense workers who are female, minority, and/or high school dropouts are concentrated in the low-skilled jobs at the bottom of the industry pay scale. The future prospects for these individuals are the most tenuous of any defense workers. The modest standard of living they have attained has been based on the comparatively generous salaries of the defense industry. Except for clerical workers, who account for less than a third of this group, these employees have few skills or credentials to present to their next employer and may well have difficulty in finding a new job without accepting significant reductions in income, benefits, and job security. The best reemployment outcome that these workers can realistically hope for is:

- Participation in a structured training program to strengthen basic skills and provide marketable occupational skills

- Placement in a new job which offers stability and opportunities for further training and advancement

Skilled workers are an asset for the County's economic recovery. It is in the interests of the regional economy to retain and redeploy displaced workers whose skills and work habits have contributed to regional productivity. This means that reemployment programs should be adaptable, supportive of worker initiative and productivity, and targeted toward skilled occupations in key industries within the regional economy.

RECOMMENDATIONS

1. Provide comprehensive job training and supportive services in the western area of the San Fernando Valley, which has the greatest concentration of displaced aerospace workers in Los Angeles County.

2. Investigate economic dislocations in the lower income communities of each defense dependent zone. The vulnerability of these communities to economic dislocations makes it a high priority to provide well targeted and timely public sector interventions for lower income defense workers who lose their jobs as well as the communities in which they are concentrated.

3. Establish an aerospace to education career transition path to enable technically trained, unemployed aerospace workers to become math and science teachers.

4. Strengthen the information base for guiding the investment of public resources in reemployment programs by surveying and analyzing the characteristics of unemployed aerospace workers to determine the capabilities, competencies, education, skill levels, needs, wants, experience, and interests of workers from the

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[22] Wolch, Law and Takahashi, op.cit., Table 5.9.

21 industry-specific occupations shown in Table 5 that each accounted for over 200 unemployed workers in 1991.

5. Update and analyze labor market data to provide industrial and geographic information identifying growing firms which need workers with skills similar to those of displaced workers. Specific efforts should be made with these employers to overcome the stigma often associated with previous defense employment.

6. Make optimal rather than minimal matches between the skills and aptitudes of displaced workers and the requirements of new jobs. This should include use of aptitude tests, skills transference inventories, and labor market data.

7. Encourage a high degree of flexibility in the design of training and supportive service programs for laid-off defense workers so as to encourage the emergence of program models specifically tailored to the needs of skilled workers rather than the needs of socially dependent individuals.

8. Support the initiative of displaced workers in finding innovative means of becoming reemployed, including vouchers for self-selected training programs and entrepreneurial projects for becoming self-employed.

9. Support long-term retraining of workers from all skill levels who face barriers to reemployment so that they can reenter the work force in a skilled capacity. This should be achieved through coordinated and integrated activities of job training jurisdictions and local education agencies to help workers remain in carefully designed and implemented training programs long enough to achieve these skill gains.

TABLE 7

COMMUNITY AND OCCUPATIONAL CHANGES IN AEROSPACE UNEMPLOYMENT
LOS ANGELES COUNTY: 1988 AND 1991

DOT Code	Title of Occupation	1988 Unemp.	% 1988 Total	1991 Unemp.	% 1991 Total	1988–91 Change	% Change 1988–91	Change Factor
AVALON	(Venice/Hill)							
003061030	Electronic Engineer	0	0.00%	0	0.00%	0	ERR	ERR
003161014	Electronic Technician	3	0.03%	19	0.15%	16	633%	5.65
600280022	Machinist	34	0.30%	44	0.35%	10	129%	1.15
706687010	Production Assembler	0	0.00%	12	0.10%	12	ERR	ERR
726684018	Electronics Assembler	34	0.30%	37	0.29%	3	109%	0.97
806381026	Aircraft Assembler	2	0.02%	2	0.02%	0	100%	0.89
828281010	Electronics Mechanic	16	0.14%	31	0.25%	15	194%	1.73
TOTAL		89	0.80%	145	1.16%	56	163%	1.45
CANOGA PARK								
003061030	Electronic Engineer	0	0.00%	30	0.18%	30	ERR	ERR
003161014	Electronic Technician	42	0.28%	66	0.40%	24	157%	1.44
600280022	Machinist	47	0.31%	87	0.53%	40	185%	1.70
706687010	Production Assembler	0	0.00%	161	0.99%	161	ERR	ERR
726684018	Electronics Assembler	68	0.45%	365	2.24%	297	537%	4.93
806381026	Aircraft Assembler	8	0.05%	8	0.05%	0	100%	0.92
828281010	Electronics Mechanic	41	0.27%	79	0.48%	38	193%	1.77
TOTAL		206	1.38%	796	4.88%	590	386%	3.55
CARSON								
003061030	Electronic Engineer	0	0.00%	6	0.09%	6	ERR	ERR
003161014	Electronic Technician	2	0.04%	10	0.15%	8	500%	4.26
600280022	Machinist	11	0.19%	49	0.73%	38	445%	3.80
706687010	Production Assembler	0	0.00%	11	0.16%	11	ERR	ERR
726684018	Electronics Assembler	11	0.19%	35	0.52%	24	318%	2.71
806381026	Aircraft Assembler	0	0.00%	1	0.01%	1	ERR	ERR
828281010	Electronics Mechanic	13	0.23%	40	0.60%	27	308%	2.62
TOTAL		37	0.65%	152	2.27%	115	411%	3.50
COMPTON								
003061030	Electronic Engineer	0	0.00%	0	0.00%	0	ERR	ERR
003161014	Electronic Technician	6	0.09%	15	0.18%	9	250%	1.92
600280022	Machinist	31	0.48%	73	0.86%	42	235%	1.80
706687010	Production Assembler	0	0.00%	61	0.72%	61	ERR	ERR
726684018	Electronics Assembler	14	0.22%	39	0.46%	25	279%	2.13
806381026	Aircraft Assembler	6	0.09%	6	0.07%	0	100%	0.77
828281010	Electronics Mechanic	5	0.08%	13	0.15%	8	260%	1.99
TOTAL		62	0.95%	207	2.44%	145	334%	2.56
EAST LOS ANGELES								
003061030	Electronic Engineer	0	0.00%	1	0.00%	1	ERR	ERR
003161014	Electronic Technician	10	0.07%	25	0.11%	15	250%	1.49
600280022	Machinist	26	0.19%	137	0.59%	111	527%	3.14
706687010	Production Assembler	0	0.00%	232	1.00%	232	ERR	ERR
726684018	Electronics Assembler	21	0.15%	39	0.17%	18	186%	1.11
806381026	Aircraft Assembler	4	0.03%	10	0.04%	6	250%	1.49
828281010	Electronics Mechanic	5	0.04%	30	0.13%	25	600%	3.58
TOTAL		66	0.48%	474	2.04%	408	718%	4.28

DOT Code	Title of Occupation	1988 Unemp.	% 1988 Total	1991 Unemp.	% 1991 Total	1988–91 Change	% Change 1988–91	Change Factor
EL MONTE								
003061030	Electronic Engineer	0	0.00%	9	0.07%	9	ERR	ERR
003161014	Electronic Technician	1	0.01%	39	0.29%	38	3900%	31.01
600280022	Machinist	9	0.08%	104	0.77%	95	1156%	9.19
706687010	Production Assembler	0	0.00%	55	0.41%	55	ERR	ERR
726684018	Electronics Assembler	6	0.06%	111	0.82%	105	1850%	14.71
806381026	Aircraft Assembler	0	0.00%	5	0.04%	5	ERR	ERR
828281010	Electronics Mechanic	1	0.01%	27	0.20%	26	2700%	21.47
TOTAL		17	0.16%	350	2.58%	333	2059%	16.37
GLENDALE								
003061030	Electronic Engineer	0	0.00%	10	0.05%	10	ERR	ERR
003161014	Electronic Technician	6	0.09%	48	0.26%	42	800%	3.07
600280022	Machinist	11	0.16%	149	0.82%	138	1355%	5.20
706687010	Production Assembler	0	0.00%	204	1.12%	204	ERR	ERR
726684018	Electronics Assembler	8	0.11%	102	0.56%	94	1275%	4.89
806381026	Aircraft Assembler	1	0.01%	4	0.02%	3	400%	1.54
828281010	Electronics Mechanic	7	0.10%	48	0.26%	41	686%	2.63
TOTAL		33	0.47%	565	3.09%	532	1712%	6.57
HOLLYWOOD								
003061030	Electronic Engineer	0	0.00%	3	0.03%	3	ERR	ERR
003161014	Electronic Technician	8	0.10%	22	0.20%	14	275%	2.06
600280022	Machinist	8	0.10%	22	0.20%	14	275%	2.06
706687010	Production Assembler	0	0.00%	7	0.06%	7	ERR	ERR
726684018	Electronics Assembler	13	0.16%	46	0.42%	33	354%	2.65
806381026	Aircraft Assembler	2	0.02%	0	0.00%	−2	0%	0.00
828281010	Electronics Mechanic	13	0.16%	33	0.30%	20	254%	1.90
TOTAL		44	0.53%	133	1.21%	89	302%	2.27
INGLEWOOD								
003061030	Electronic Engineer	0	0.00%	12	0.12%	12	ERR	ERR
003161014	Electronic Technician	17	0.17%	48	0.46%	31	282%	2.68
600280022	Machinist	54	0.55%	72	0.69%	18	133%	1.27
706687010	Production Assembler	0	0.00%	24	0.23%	24	ERR	ERR
726684018	Electronics Assembler	75	0.76%	78	0.75%	3	104%	0.99
806381026	Aircraft Assembler	20	0.20%	19	0.18%	−1	95%	0.90
828281010	Electronics Mechanic	38	0.39%	52	0.50%	14	137%	1.30
TOTAL		204	2.07%	305	2.94%	101	150%	1.42
LAKEWOOD								
003061030	Electronic Engineer	0	0.00%	6	0.08%	6	ERR	ERR
003161014	Electronic Technician	3	0.06%	32	0.44%	29	1067%	7.55
600280022	Machinist	108	2.09%	106	1.45%	−2	98%	0.69
706687010	Production Assembler	0	0.00%	17	0.23%	17	ERR	ERR
726684018	Electronics Assembler	8	0.15%	32	0.44%	24	400%	2.83
806381026	Aircraft Assembler	2	0.04%	17	0.23%	15	850%	6.02
828281010	Electronics Mechanic	18	0.35%	39	0.53%	21	217%	1.53
TOTAL		139	2.68%	249	3.40%	110	179%	1.27
LANCASTER								
003061030	Electronic Engineer	0	0.00%	33	0.18%	33	ERR	ERR
003161014	Electronic Technician	187	1.11%	149	0.81%	−38	80%	0.73
600280022	Machinist	46	0.27%	179	0.98%	133	389%	3.58
706687010	Production Assembler	0	0.00%	45	0.25%	45	ERR	ERR
726684018	Electronics Assembler	19	0.11%	47	0.26%	28	247%	2.28
806381026	Aircraft Assembler	185	1.10%	333	1.82%	148	180%	1.66
828281010	Electronics Mechanic	33	0.20%	59	0.32%	26	179%	1.65
TOTAL		470	2.79%	845	4.61%	375	180%	1.65

DOT Code	Title of Occupation	1988 Unemp.	% 1988 Total	1991 Unemp.	% 1991 Total	1988–91 Change	% Change 1988–91	Change Factor
LINCOLN HEIGHTS								
003061030	Electronic Engineer	0	0.00%	0	0.00%	0	ERR	ERR
003161014	Electronic Technician	0	0.00%	3	0.12%	3	ERR	ERR
600280022	Machinist	1	0.04%	17	0.68%	16	1700%	16.24
706687010	Production Assembler	0	0.00%	27	1.07%	27	ERR	ERR
726684018	Electronics Assembler	1	0.04%	14	0.56%	13	1400%	13.38
806381026	Aircraft Assembler	0	0.00%	0	0.00%	0	ERR	ERR
828281010	Electronics Mechanic	0	0.00%	1	0.04%	1	ERR	ERR
TOTAL		2	0.08%	62	2.47%	60	3100%	29.62
LONG BEACH								
003061030	Electronic Engineer	0	0.00%	25	0.23%	25	ERR	ERR
003161014	Electronic Technician	6	0.07%	35	0.33%	29	583%	4.96
600280022	Machinist	13	0.14%	66	0.62%	53	508%	4.32
706687010	Production Assembler	0	0.00%	8	0.08%	8	ERR	ERR
726684018	Electronics Assembler	5	0.06%	38	0.36%	33	760%	6.47
806381026	Aircraft Assembler	2	0.02%	11	0.10%	9	550%	4.68
828281010	Electronics Mechanic	6	0.07%	68	0.64%	62	1133%	9.64
TOTAL		32	0.35%	251	2.36%	219	784%	6.68
LOS ANGELES CENTRAL (Broadway/Venice)								
003061030	Electronic Engineer	0	0.00%	1	0.01%	1	ERR	ERR
003161014	Electronic Technician	3	0.04%	6	0.05%	3	200%	1.30
600280022	Machinist	7	0.09%	22	0.18%	15	314%	2.04
706687010	Production Assembler	0	0.00%	16	0.13%	16	ERR	ERR
726684018	Electronics Assembler	6	0.08%	30	0.25%	24	500%	3.24
806381026	Aircraft Assembler	0	0.00%	1	0.01%	1	ERR	ERR
828281010	Electronics Mechanic	4	0.05%	20	0.16%	16	500%	3.24
TOTAL		20	0.25%	96	0.79%	76	480%	3.11
NORTH HOLLYWOOD								
003061030	Electronic Engineer	0	0.00%	13	0.07%	13	ERR	ERR
003161014	Electronic Technician	16	0.16%	57	0.31%	41	356%	2.00
600280022	Machinist	22	0.22%	170	0.93%	148	773%	4.35
706687010	Production Assembler	0	0.00%	218	1.20%	218	ERR	ERR
726684018	Electronics Assembler	11	0.11%	131	0.72%	120	1191%	6.70
806381026	Aircraft Assembler	0	0.00%	13	0.07%	13	ERR	ERR
828281010	Electronics Mechanic	10	0.10%	66	0.36%	56	660%	3.71
TOTAL		59	0.58%	668	3.67%	609	1132%	6.37
NORWALK								
003061030	Electronic Engineer	0	0.00%	2	0.02%	2	ERR	ERR
003161014	Electronic Technician	2	0.03%	15	0.17%	13	750%	4.99
600280022	Machinist	5	0.09%	88	1.02%	83	1760%	11.71
706687010	Production Assembler	0	0.00%	33	0.38%	33	ERR	ERR
726684018	Electronics Assembler	1	0.02%	35	0.40%	34	3500%	23.29
806381026	Aircraft Assembler	1	0.02%	6	0.07%	5	600%	3.99
828281010	Electronics Mechanic	0	0.00%	38	0.44%	38	ERR	ERR
TOTAL		9	0.16%	217	2.50%	208	2411%	16.05
PASADENA								
003061030	Electronic Engineer	0	0.00%	15	0.15%	15	ERR	ERR
003161014	Electronic Technician	7	0.12%	48	0.49%	41	686%	4.21
600280022	Machinist	6	0.10%	85	0.87%	79	1417%	8.69
706687010	Production Assembler	0	0.00%	6	0.06%	6	ERR	ERR
726684018	Electronics Assembler	3	0.05%	49	0.50%	46	1633%	10.02
806381026	Aircraft Assembler	3	0.05%	3	0.03%	0	100%	0.61
828281010	Electronics Mechanic	3	0.05%	45	0.46%	42	1500%	9.21
TOTAL		22	0.37%	251	2.56%	229	1141%	7.00

DOT Code	Title of Occupation	1988 Unemp.	% 1988 Total	1991 Unemp.	% 1991 Total	1988–91 Change	% Change 1988–91	Change Factor
POMONA								
003061030	Electronic Engineer	0	0.00%	20	0.18%	20	ERR	ERR
003161014	Electronic Technician	41	0.42%	52	0.46%	11	127%	1.09
600280022	Machinist	46	0.47%	120	1.05%	74	261%	2.24
706687010	Production Assembler	0	0.00%	64	0.56%	64	ERR	ERR
726684018	Electronics Assembler	23	0.23%	93	0.82%	70	404%	3.47
806381026	Aircraft Assembler	2	0.02%	0	0.00%	−2	0%	0.00
828281010	Electronics Mechanic	12	0.12%	42	0.37%	30	350%	3.01
TOTAL		124	1.26%	391	3.43%	267	315%	2.71
SAN FERNANDO								
003061030	Electronic Engineer	0	0.00%	8	0.09%	8	ERR	ERR
003161014	Electronic Technician	14	0.62%	36	0.39%	22	257%	0.63
600280022	Machinist	12	0.53%	96	1.05%	84	800%	1.97
706687010	Production Assembler	0	0.00%	58	0.63%	58	ERR	ERR
726684018	Electronics Assembler	7	0.31%	104	1.13%	97	1486%	3.66
806381026	Aircraft Assembler	3	0.13%	5	0.05%	2	167%	0.41
828281010	Electronics Mechanic	11	0.49%	40	0.44%	29	364%	0.90
TOTAL		47	2.08%	347	3.78%	300	738%	1.82
SANTA MONICA		(1990)	(1990%)					
003061030	Electronic Engineer	0	0.00%	0	0.00%	0	ERR	ERR
003161014	Electronic Technician	1	0.13%	3	0.15%	2	300%	1.16
600280022	Machinist	4	0.52%	9	0.46%	5	225%	0.87
706687010	Production Assembler	0	0.00%	0	0.00%	0	ERR	ERR
726684018	Electronics Assembler	6	0.79%	8	0.41%	2	133%	0.52
806381026	Aircraft Assembler	1	0.13%	1	0.05%	0	100%	0.39
828281010	Electronics Mechanic	3	0.39%	7	0.35%	4	233%	0.90
TOTAL		15	1.97%	28	1.42%	13	187%	0.72
SOUTH CENTRAL LOS ANGELES (Avalon/El Segundo)								
003061030	Electronic Engineer	0	0.00%	0	0.00%	0	ERR	ERR
003161014	Electronic Technician	3	0.03%	20	0.00%	17	667%	0.00
600280022	Machinist	3	0.03%	49	0.14%	46	1633%	5.62
706687010	Production Assembler	0	0.00%	32	0.35%	32	ERR	ERR
726684018	Electronics Assembler	8	0.07%	52	0.23%	44	650%	3.37
806381026	Aircraft Assembler	1	0.01%	14	0.37%	13	1400%	43.83
828281010	Electronics Mechanic	2	0.02%	20	0.10%	18	1000%	5.90
TOTAL		17	0.14%	187	0.14%	170	1100%	0.99
SOUTH GATE								
003061030	Electronic Engineer	0	0.00%	1	0.01%	1	ERR	ERR
003161014	Electronic Technician	3	0.03%	5	0.05%	2	167%	1.87
600280022	Machinist	14	0.13%	80	0.86%	66	571%	6.40
706687010	Production Assembler	0	0.00%	24	0.26%	24	ERR	ERR
726684018	Electronics Assembler	6	0.06%	41	0.44%	35	683%	7.65
806381026	Aircraft Assembler	1	0.01%	2	0.02%	1	200%	2.24
828281010	Electronics Mechanic	3	0.03%	22	0.24%	19	733%	8.21
TOTAL		27	0.26%	175	1.88%	148	648%	7.26
TORRANCE								
003061030	Electronic Engineer	0	0.00%	92	0.64%	92	ERR	ERR
003161014	Electronic Technician	65	0.37%	84	0.59%	19	129%	1.56
600280022	Machinist	95	0.55%	136	0.95%	41	143%	1.73
706687010	Production Assembler	0	0.00%	24	0.17%	24	ERR	ERR
726684018	Electronics Assembler	121	0.70%	77	0.54%	−44	64%	0.77
806381026	Aircraft Assembler	12	0.07%	17	0.12%	5	142%	1.71
828281010	Electronics Mechanic	47	0.27%	85	0.59%	38	181%	2.19
TOTAL		340	1.96%	515	3.59%	175	151%	1.83

DOT Code	Title of Occupation	1988 Unemp.	% 1988 Total	1991 Unemp.	% 1991 Total	1988–91 Change	% Change 1988–91	Change Factor
WEST COVINA								
003061030	Electronic Engineer	0	0.00%	10	0.09%	10	ERR	ERR
003161014	Electronic Technician	3	0.03%	30	0.27%	27	1000%	10.49
600280022	Machinist	8	0.07%	131	1.16%	123	1638%	17.18
706687010	Production Assembler	0	0.00%	98	0.87%	98	ERR	ERR
726684018	Electronics Assembler	4	0.03%	105	0.93%	101	2625%	27.54
806381026	Aircraft Assembler	1	0.01%	6	0.05%	5	600%	6.29
828281010	Electronics Mechanic	5	0.04%	53	0.47%	48	1060%	11.12
TOTAL		21	0.18%	433	3.85%	412	2062%	21.63
WEST LOS ANGELES		(1989)	(1989%)					
003061030	Electronic Engineer	0	0.00%	11	0.09%	11	ERR	ERR
003161014	Electronic Technician	3	0.07%	17	0.14%	14	567%	1.94
600280022	Machinist	9	0.22%	38	0.32%	29	422%	1.45
706687010	Production Assembler	0	0.00%	7	0.06%	7	ERR	ERR
726684018	Electronics Assembler	11	0.27%	52	0.44%	41	473%	1.62
806381026	Aircraft Assembler	2	0.05%	6	0.05%	4	300%	1.03
828281010	Electronics Mechanic	11	0.27%	48	0.41%	37	436%	1.50
TOTAL		36	0.89%	179	1.52%	143	497%	1.71
WHITTIER								
003061030	Electronic Engineer	0	0.00%	4	0.04%	4	ERR	ERR
003161014	Electronic Technician	11	0.10%	17	0.17%	6	155%	1.70
600280022	Machinist	105	0.94%	93	0.91%	−12	89%	0.97
706687010	Production Assembler	0	0.00%	155	1.52%	155	ERR	ERR
726684018	Electronics Assembler	14	0.13%	29	0.28%	15	207%	2.28
806381026	Aircraft Assembler	7	0.06%	6	0.06%	−1	86%	0.94
828281010	Electronics Mechanic	22	0.20%	42	0.41%	20	191%	2.10
TOTAL		159	1.42%	346	3.40%	187	218%	2.39
COMBINED TOTAL		2297	1.00%	8367	2.78%	6070	364%	2.79

Chapter 7

REEMPLOYMENT OPPORTUNITIES AND NEEDS IN THE AEROSPACE HIGH TECHNOLOGY INDUSTRY COMPLEX

1991 LOS ANGELES COUNTY

by Odessa Dubinsky

SUMMARY OF FINDINGS

- **Workers now losing jobs in aerospace have better education, broader competencies and more intensive training than in previous lay-offs, but the transition to other jobs will be very difficult, often requiring extensive reeducation and acceptance of lower pay.**

- **Thirty-eight percent of laid-off aerospace workers will probably have to change occupations and be retrained in order to find a new job.**

- **Seventy-six percent of those workers needing retraining will require from 6 to 18 months of training to obtain jobs at a skill level comparable to their old jobs.**

- **There are not any industries doing large scale hiring that could absorb aerospace workers. To find new jobs it is necessary to analyze skills of individual workers, examine the local labor market potential for those skills, look at possible alternative occupations, identify industries offering the best job potential, and make use of specific types of training to enhance employability of the individual worker.**

What started as a marriage of convenience between Southern California and the industrial conglomerate known as aerospace-high technology became an apparently strong, stable, and permanent relationship stretching from the early forties into its heights of prosperity and well-being in the late eighties.

The extended honeymoon between Los Angeles County and the industry complex began to falter in 1987, as defense budgets were reduced, and procurement of military aircraft and missile systems was cut back. The "cold-war" provocations since World War II led to greater and greater war material build-up, with production and employment in aircraft, missile, and ground armaments growing almost exponentially. The loss of the "Wall" and the break up of the Soviet empire forced acknowledgement and finally some actualization of the opportunities to reduce defense expenditures. These actions included canceling and "stretching" contracts with Los Angeles County aerospace firms.

Over the years since the inception of aircraft production in Los Angeles, there have been a number of periods marked by job losses in the industry. In each instance, up until the

current period--there has been a "reconciliation" and an even happier era with more contracts and higher employment levels plus expansion of industrial activities into high technology including space vehicle development and production, guided missiles, and a great variety of related electronics, computer, and communications equipment.

The aerospace complex required different types of workers, ranging from large numbers of assembly line production workers with small scopes of knowledge and blue collar skills to highly proficient, extensively educated and well-trained technologists, specialists, engineers and scientists.

Previous layoffs have been just that -- a relatively temporary condition during which the unemployed workers could usually move over to another plant not affected by a specific contract conclusion or cancellation, or to a different industry using similar job classifications or skills, viz: shipbuilding or automobile assembly; or even to a different location of the same firm. During the twenty years prior to 1987 the longest duration of employment decline in aerospace-high technology firms was about two years-- between 1974 and 1977. The industry is now in the fifth year of constant employment loss and almost all plants in the complex locally and elsewhere in the United States are similarly affected.

Another difference between this cutback and previous cutbacks is that recent reductions in force have been generally wide-spread and distributed fairly equally among all occupations. There seems to be some evidence that top level and top rated scientists and engineers were protected from layoffs somewhat longer than production and support staff workers. As the reduction grew in volume and pace, however, the distinction in class terminations lessened.

There is also far less chance of a renewal of activities or call back to the former employer, some of whom are moving bodily from the area to other states, or closing down entire facilities. There are also fewer opportunities for obtaining a job in a different industrial activity since the whole economic base of the county is in some phase of a recession.

In order to develop a basic structure for a comprehensive employment program as part of Los Angeles County's Economic Adjustment Strategy, an occupational/industrial matrix has been formulated which shows the number of workers by occupational classification in thirty-one selected titles for each of the seven industries considered as making up the high-technology/aerospace conglomerate. The occupational structure was obtained from the Occupational Employment Statistics Survey, using occupational coding based on the Standard Occupational Classification Manual, developed by the Office of Management and Budget, U.S. Department of Commerce.

The matrix for the seven industries and the thirty-one occupations was produced by the Labor Market Information Service of the Employment Development Department for the

TABLE I

ESTIMATED AND PROJECTED EMPLOYMENT BY SELECTED OCCUPATIONS IN HIGH TECHNOLOGY & AEROSPACE INDUSTRIES LOS ANGELES COUNTY 1988 & 1993

OCCUPATION TITLE	TOTAL		SIC:357 COMPUTER & OFFICE EQUIPMENT		SIC:366 COMMUNICATION EQUIPMENT		SIC:367 ELECTRONIC COMPONENTS		SIC:372 AIRCRAFT & PARTS		SIC:376 GUIDED MISSILES SPACE VEHICLES		SIC:381 SEARCH & NAVIGATION EQUIPMENT		SIC:382 MEASURING & CONTROLLING EQUIPMENT	
PERIOD	1988	1993	1988	1993	1988	1993	1988	1993	1988	1993	1988	1993	1988	1993	1988	1993
Estimated Total Employment	*281,000*	*259,700*	*13,500*	*14,100*	*5,200*	*5,400*	*27,400*	*28,000*	*125,200*	*115,600*	*18,400*	*14,400*	*76,600*	*67,600*	*14,700*	*14,600*
Employment in 31 Occupations	*148,373*	*137,871*	*6,966*	*7,251*	*3,102*	*3,182*	*14,744*	*14,960*	*62,534*	*58,368*	*9,807*	*7,764*	*43,908*	*39,194*	*7,312*	*7,152*
Accounting Clerks	1,662	1,431	198	177	87	82	303	290	486	401	56	42	352	273	180	166
Aircraft Mechanics	2,468	2,214	0	0	0	0	0	0	2,402	2,160	66	54	0	0	0	0
Assemblers, Aircraft	3,453	3,078	0	0	0	0	0	0	3,453	3,078	0	0	0	0	0	0
Assemblers, Electro Mechanical	3,248	3,034	266	251	17	18	369	407	1,030	943	582	487	504	424	480	504
Assemblers, Electronic & Elec.	6,997	4,961	419	288	295	219	3,241	2,498	1,006	656	586	314	794	486	656	500
Assemblers & Fabric, Non-elec.	5,298	4,668	172	183	232	236	953	965	1,408	1,255	578	420	609	513	1,346	1,096
Assemblers, Elect. Equip. Precision	6,786	6,253	466	492	577	581	1,237	1,306	494	447	254	192	3,268	2,753	490	482
Computer Operators	1,054	1,014	85	99	26	27	66	74	381	366	63	51	395	359	38	38
Computer Programmers	1,941	2,040	755	835	34	38	97	114	659	663	84	72	198	189	114	129
Drafters	1,530	1,299	82	77	105	98	234	223	327	268	145	102	416	323	221	208
Electronic Repairers	392	356	0	0	8	9	83	92	125	119	176	136	0	0	0	0
Engineers, Aircraft & Aerospace	13,470	13,058	0	0	0	0	0	0	11,885	11,714	1,585	1,344	0	0	0	0
Engineers, Electrical & Electronic	13,148	13,872	784	970	457	547	1,175	1,455	2,223	2,349	807	698	7,179	7,217	523	636
Engineers, Industrial	8,076	8,131	74	92	41	48	174	210	4,100	4,253	758	641	2,842	2,788	87	99
General Office Clerks	3,091	2,754	311	304	57	58	281	289	1,288	1,143	297	221	725	606	132	133
General Secretaries	7,021	5,887	521	497	149	140	424	409	2,713	2,257	125	100	2,707	2,121	382	363
Machinists	4,950	4,482	29	28	32	31	175	182	3,751	3,378	339	294	383	314	241	255
Managers, Engineering, Math, Sci.	8,306	7,482	368	400	139	143	598	611	2,641	2,421	211	173	4,124	3,503	225	231
Managers, Industrial Production	4,436	4,074	216	231	76	80	482	490	2,049	1,878	413	331	894	759	306	305
Numerical Control Operator	2,308	2,190	43	39	2	2	339	370	1,549	1,456	174	141	175	155	26	27
Operating Systems Researchers	505	465	0	0	2	2	5	6	373	357	79	61	46	39	0	0
Precision Inspectors	8,303	7,388	472	428	85	86	985	1,035	3,248	2,893	695	516	2,563	2,160	255	270
Production Inspectors	3,436	3,194	144	148	118	121	896	937	1,216	1,084	517	405	307	259	238	240
Production, Plan. & Exped. Clerks	6,799	6,256	157	159	59	62	516	552	4,515	4,125	132	110	1,288	1,113	132	135
Purchasing Agents	3,928	3,419	138	135	89	88	224	227	2,012	1,745	148	111	1,112	912	205	201
Sheetmetal Workers	1,493	1,369	0	0	10	10	6	6	1,259	1,147	34	27	120	103	64	76
Stock Clerks	3,370	2,742	101	91	84	81	260	251	1,298	1,068	539	379	901	700	187	172
Systems Analysts	6,040	5,771	248	295	38	44	77	94	2,433	2,564	118	106	3,090	2,625	36	43
Technicians, Mechanical Engineering	1,739	1,394	51	42	4	5	93	91	298	242	49	40	1,130	877	114	97
Technicians & Technologist, Elect.	12,344	12,838	761	877	247	291	1,396	1,715	1,543	1,594	182	183	7,616	7,472	599	706
Technical Writers	781	757	105	113	32	35	55	61	369	344	15	13	170	151	35	40

SOURCES

"Projections of Employment 1988–1993," EDD

Occupational Distribution: Special Run of OES Data by Industry, EDD

Occupations: Occupational Employment Statistics Survey

High Technology–Aerospace Industries – Industries selected are those involved in production of defense related material.

purpose of this report, and shows actual 1988 employment data, projected 1993 employment data, and estimates of 1991 data.

While several hundred different occupational titles can be found among the seven industries, analysis of the data showed that thirty-one occupations, ranging from clerical and semi-skilled jobs through professional and managerial positions represented more than 53% of total employment in the entire group. Most of the thirty-one occupations were to be found in each of the seven different industries, while a few were indigenous to a single industry.

Tables I - III

Since reductions in force have been generally wide-spread with all occupations bearing some of the brunt, and since over half of all workers were employed in the 31 selected occupations, these were given special attention in an effort to indicate possible transition paths to other employment.

Tables I and II show the occupation/industry matrix with actual employment data for 1988 and projections for 1993. Table III shows the difference between the projected trends and what has actually happened to employment in the seven industries. It should be noted that while employment has been reduced far more than anticipated in some industries the five year period still has two years to go, and there could be some recovery of staffing if some aircraft plants retool and change production output. Several firms have indicated they will move into commercial production and do not expect to depend on government/military contracts to the same extent; at least one firm has reported interest in selling part of their operations to foreign buyers.

However, it is not likely that such changes in production will require the same occupational structure/classifications/volume as before.

Analysis of Tables I and II

The aerospace industry from its beginning in Southern California was bound to the area by its geographic location, the weather, research - e.g. Theodore von Karman at Cal Tech, facility space, government subsidies and contracts, and a ready and expanding labor force. The latter was drawn in large part to California by the same attractions that brought the industry there, plus the promise of good wages, excellent universities, and the challenge of a new, varied and exciting range of potential jobs.

The data in Tables I and II show that over 13 percent of aerospace workers are in an engineering field. Another 17 percent are highly skilled technicians and technologists, 11 percent are at the management level, and 25 percent are in line jobs (assembly workers and inspectors).

TABLE II

PERCENTAGE OF ESTIMATED EMPLOYMENT BY SELECTED OCCUPATIONS IN HIGH TECHNOLOGY & AEROSPACE INDUSTRIES
LOS ANGELES COUNTY 1991

OCCUPATION TITLE Selected occupations as percent	TOTAL	SIC:357 COMPUTER & OFFICE EQUIPMENT	SIC:366 COMMUNICATION EQUIPMENT	SIC:367 ELECTRONIC COMPONENTS	SIC:372 AIRCRAFT & PARTS	SIC:376 GUIDED MISSILES, SPACE VEHICLES	SIC:381 SEARCH & NAVIGATION EQUIPMENT	SIC:382 MEASURING & CONTROLLING EQUIPMENT
Estimated Total Employment	*127,400*	*5,600*	*3,100*	*13,200*	*56,300*	*7,200*	*35,600*	*6,400*
Employment in Selected Occupations	*53.1%*	*51.4%*	*58.9%*	*53.4%*	*50.5%*	*53.9%*	*58.0%*	*49.0%*
Accounting Clerks	0.6%	1.3%	1.5%	1.0%	0.3%	0.3%	0.3%	1.1%
Aircraft Mechanics	0.9%	0.0%	0.0%	0.0%	1.9%	0.4%	0.0%	0.0%
Assemblers, Aircraft	1.2%	0.0%	0.0%	0.0%	2.7%	0.0%	0.0%	0.0%
Assemblers, Electro Mechanical Equip.	1.2%	1.8%	0.3%	1.5%	0.8%	3.4%	0.6%	3.5%
Assemblers, Electronic & Electrical	1.9%	2.1%	4.1%	8.9%	0.6%	2.2%	0.7%	3.4%
Assemblers & Fabricators, Non-electrical	1.8%	1.3%	4.4%	3.4%	1.1%	2.9%	0.7%	7.5%
Assemblers, Elect. Equip. Precision	2.4%	3.5%	10.8%	4.7%	0.4%	1.3%	4.1%	3.3%
Computer Operators	0.4%	0.7%	0.5%	0.3%	0.3%	0.4%	0.5%	0.3%
Computer Programmers	0.8%	5.9%	0.7%	0.4%	0.6%	0.5%	0.3%	0.9%
Drafters	0.5%	0.5%	1.8%	0.8%	0.2%	0.7%	0.5%	1.4%
Electronic Repairers	0.1%	0.0%	0.2%	0.3%	0.1%	0.9%	0.0%	0.0%
Engineers, Aircraft & Aerospace	5.0%	0.0%	0.0%	0.0%	10.1%	9.3%	0.0%	0.0%
Engineers, Electrical & Electronic	5.3%	6.9%	10.1%	5.2%	2.1%	4.8%	10.7%	4.3%
Engineers, Industrial	3.1%	0.7%	0.9%	0.8%	3.7%	4.5%	4.1%	0.7%
General Office Clerks	1.1%	2.2%	1.1%	1.0%	1.0%	1.5%	0.9%	0.9%
General Secretaries	2.3%	3.5%	2.6%	1.5%	2.0%	0.7%	3.1%	2.5%
Machinists	1.7%	0.2%	0.6%	0.7%	2.9%	2.0%	0.5%	1.7%
Managers, Engineering, Math, Science	2.9%	2.8%	2.6%	2.2%	2.1%	1.2%	5.2%	1.6%
Managers, Industrial Production	1.7%	1.6%	1.5%	1.8%	1.6%	2.3%	1.1%	2.1%
Numerical Control Operator	0.8%	0.3%	0.0%	1.3%	1.2%	1.0%	0.2%	0.2%
Operating Systems Researchers	0.2%	0.0%	0.0%	0.0%	0.3%	0.4%	0.1%	0.0%
Precision Inspectors	2.8%	3.0%	1.6%	3.7%	2.5%	3.6%	3.2%	1.8%
Production Inspectors	1.2%	1.0%	2.2%	3.3%	0.9%	2.8%	0.4%	1.7%
Production, Planning & Expediting Clerks	2.4%	1.1%	1.2%	2.0%	3.6%	0.8%	1.7%	0.9%
Purchasing Agents	1.3%	1.0%	1.6%	0.8%	1.5%	0.8%	1.4%	1.4%
Sheetmetal Workers	0.5%	0.0%	0.2%	0.0%	1.0%	0.2%	0.2%	0.5%
Stock Clerks	1.1%	0.6%	1.5%	0.9%	1.0%	2.6%	1.0%	1.2%
Systems Analysts	2.2%	2.1%	0.8%	0.3%	2.2%	0.7%	3.9%	0.3%
Technicians, Mechanical Engineering	0.5%	0.3%	0.1%	0.3%	0.2%	0.3%	1.3%	0.7%
Technicians & Technologist, Elect.	4.9%	6.2%	5.4%	6.1%	1.3%	1.3%	11.1%	4.8%
Technical Writers	0.3%	0.8%	0.6%	0.2%	0.3%	0.1%	0.2%	0.3%

FOOTNOTES

Percentages based on OES survey data for manufacturing firms; and applied to 1991 estimates of total employment Jan.-June average 1991

TABLE III

PROJECTED AND ACTUAL CHANGES IN EMPLOYMENT IN HIGH TECHNOLOGY – AEROSPACE INDUSTRIES
LOS ANGELES COUNTY 1988 – 1991 – 1993

SIC CODE	INDUSTRY	ANNUAL AVERAGE EMPLOYMENT 1998	PROJECTED EMPLOYMENT 1993	ACTUAL AVERAGE EMPLOYMENT JAN/JUNE 1991	PROJECTED NUMERICAL CHANGE 1988–1993	ACTUAL NUMERICAL CHANGE 1988–1991	PROJECTED PERCENTAGE CHANGE 1988–1993	ACTUAL PERCENTAGE CHANGE 1988–1991
	TOTAL	281.0	259.7	240.0	−21.3	−41.0	−7.6%	−14.6%
357	Computer & Office Equipment	13.5	14.1	10.9	0.6	−2.6	4.4%	−19.3%
366	Communications Equipment	5.2	5.4	5.1	0.2	−0.1	3.8%	−1.9%
367	Electronic Components & Accessories	27.4	28.0	24.6	0.6	−2.8	2.2%	−10.2%
372	Aircraft & Parts	125.2	115.6	111.5	−9.6	−13.7	−7.7%	−10.9%
376	Guided Missiles, Space Vehicles	18.4	14.4	13.4	−4.0	−5.0	−21.7%	−27.2%
381	Search & Navigation Equipment	76.6	67.6	61.4	−9.0	−15.2	−11.7%	−19.8%
382	Measuring & Controlling Equipment	14.7	14.6	13.1	−0.1	−1.6	−0.7%	−10.9%

Estimated employment data for 1988 and 1991 from Labor Market Information Division, EDD Los Angeles.

Projections of 1993 Employment form "Projection of Employment 1988–1993," Produced and published by State of California.
Employment Development Department, Labor Market Information Division

These data indicate that at over 50% of all workers are relatively well educated, and probably have a college degree. Another 15 percent are in clerical positions, and it can be assumed that most of these have finished high school and/or taken business courses at a higher level. These assumptions help differentiate recently terminated workers and those who will terminated in the near future from workers who were affected by layoffs in the sixties and seventies. Many of the engineers, technicians, and technologists who worked in aircraft plants from the late forties into the seventies learned their skills on the job, by expediency, and as the jobs developed. A vocationally trained "educated" work force was not available, and many of the higher ranked workers laid off in the sixties and seventies found it almost impossible to obtain jobs at their accustomed skill or wages levels. Other employers were reluctant to hire workers who were waiting and expecting to be recalled to aircraft plants. They were sometimes rehired by their old firms when new contracts were received. Many drifted into other occupations, retired, or left the area. And many just waited, hoping for rehire. These workers were likely to be in their late forties and older.

The present group of unemployed workers will find transition to other jobs equally if not more difficult, despite their relative youth (most are between 30 and 45), and their higher levels of education, broader competencies, and more intensive training. Call-back to former jobs is unlikely, few new jobs are expected, and ready absorption into other industries will probably require extensive reeducation, and acceptance of lower pay.

Table IV

Table IV shows the results of the analysis of the 31 selected occupations. The information about the 31 occupations can be found in individual occupational "Briefs" that follow in this chapter. The Briefs were prepared as a means of identifying the competencies and potential capabilities of workers most likely to have been or to be affected by reductions-in-force at aerospace and high technology firms.

Occupational Briefs

Thirty-one occupations were selected for special study and determination of possible occupational transition paths to new, productive jobs, either utilizing existing skills or by the addition of new or enhanced skills acquired through training/education. These thirty-one occupations include those that are largest in aerospace as well as those requiring separate analysis.

The Brief form was designed to provide a maximum of data about the characteristics, duties, and potential of workers currently or recently employed in the occupations as concisely as possible so that the information could be used readily and efficiently by persons dealing with the laid-off aerospace workers, providing them with information, or trying to find solutions to their individual problems.

TABLE IV

SUMMARY OF OCCUPATIONAL TRANSITION PATH DATA FOR 31 SELECTED OCCUPATIONS
LOS ANGELES COUNTY 1991

OCCUPATION TITLE Selected occupations	NO. OF JOBS IN ALL INDUSTRIES	NO. OF JOBS IN HI-TECH/ AEROSPACE	EST. NO. OF UNEMPLOYED WORKERS	JOB ATTAINMENT POTENTIAL			TRAINING NEED		
				GOOD	FAIR	POOR	1	2	3
TOTAL	668,600	127,400	30,028						
Accounting Clerks	83,300	1,400	4,408	X	X		X		
Aircraft Mechanics	4,700	2,200	395			X		X	
Assemblers, Aircraft	3,000	2,900	978			X		X	X
Assemblers, Electro Mechanical Equip.	3,850	2,900	72	X	X		X		
Assemblers, Electronic & Electrical	7,300	4,600	1,864		X	X	X	X	
Assemblers & Fabricators, Non-electrical	49,300	4,300	2,799			X		X	
Assemblers, Elect. Equip. Precision	7,700	5,800	123			X		X	
Computer Operators	12,800	950	1,560		X			X	
Computer Programmers	20,100	1,900	195	X			X	X	X
Drafters	11,100	1,200	558			X		X	X
Electronic Repairers	2,150	200	290			X		X	
Engineers, Aircraft & Aerospace	12,800	12,000	207			X			X
Engineers, Electrical & Electronic	25,700	12,900	709	X				X	
Engineers, Industrial	10,700	7,400	178	X				X	X
General Office Clerks	121,000	2,650	1,994	X	X			X	
General Secretaries	98,400	5,500	4,579	X				X	X
Machinists	17,100	4,100	2,377	X	X			X	
Managers, Engineering, Math, Science	15,400	7,000	24	X	X			X	
Managers, Industrial Production	11,500	4,000	175	X	X			X	X
Numerical Control Operator	4,300	1,900	250			X		X	X
Operating Systems Researchers	2,600	400	20	X	X			X	X
Precision Inspectors	12,000	6,700	32		X	X	X	X	
Production Inspectors	14,100	2,900	165	X	X		X		
Production, Planning & Expediting Clerks	16,500	5,800	319	X	X		X	X	
Purchasing Agents	9,850	3,100	576		X	X			X
Sheetmetal Workers	7,800	1,200	406		X	X		X	
Stock Clerks	32,100	2,600	3,193		X	X		X	
Systems Analysts	21,000	5,300	248	X			X		
Technicians, Mechanical Engineering	2,800	1,200	83		X		X	X	
Technicians & Technologist, Elect.	26,100	11,900	1,069	X				X	
Technical Writers	1,550	700	182	X	X				X

SOURCE
Employment – Detailed Occupational Projections 1988–1993, using midpoint, EDD.
Unemployment – B96 Reports June 1991, EDD

JOBS POTENTIAL
Good – Immediate (within 2–4 months of layoff)
Fair – Within 4–6 months of layoff
Poor – over 6 months or none. Probably require change of occupation & retraining or upgrading of skills.

TRAINING
1 – One month – 6 mos. refresher, OJT, and/or additional skills (same level but different)
2 – 6 mos. to 18 mos. upgrade, new and additional skills (higher level)
3 – 18 mos. plus, change of occupation, new skills, intensive upgrading.

The occupational titles are those used by Bureau of Labor Statistics in its Occupational Employment Statistics (OES) Survey of Occupations. The occupations have been coded (assigned identifying numbers) by the OES using a coding systems based on the Standard Occupational Classification (SOC) Manual, 1980, (U.S. Dept. of Commerce). The SOC and the OES occupational titles and codes are logical groupings of fine grained occupations defined in the Dictionary of Occupational Titles (U.S. Dept. of Labor), which is the original source of much of the data used to classify and group occupations in the OES system, and therefore, in this report.

The foregoing information has been presented in some detail in order to delineate the breadth and scope of occupational activity covered by the thirty-one selected occupations. Some of the titles include only four and five distinct and separately defined occupations, e.g. Systems Analyst has five separate titles and DOT codes; while some include several hundred titles, such as Assembler Fabricator, except Machine, which covers over 800 individual DOT titles and codes.

The Briefs have been set up in five sections:

A. Job Descriptions
B. Local Labor Market Absorption Potential in Same Job
C. Possible Alternative Occupations
D. Industries in the Area Offering the Best Job Potential
E. Suggested Training for Increasing Employability

A. *Job Description*

A job description covering the major tasks, activities, and responsibilities has been provided in order to give the user sufficient information about the actual skill, scope, and level of the occupation to facilitate referral to another job, training, or counseling service. The multitude and diversity of occupations (over 12,000 are defined in the DOT) limit our ability to comprehend and appreciate the specific and actual activities performed on jobs other than our own or those we see around us regularly. The task delineation provides a means of determining comparability with other jobs with different titles, but similar task requirements. This provides a more informed basis for directing the individual into new areas of work by helping to ascertain his or her interests and physical/mental abilities, and those skills already acquired, and recommending areas and levels of retraining, new training, education and/or supportive service.

The job description has been made sufficiently inclusive to cover a variety of job assignments under the same OES titles.

B. *Local Labor Market Absorption Potential in the Same Job*

Labor market absorption potential was rated on a three level scale:

1.**Good** (reemployment probable 6 weeks to 4 months after termination)

A worker will probably obtain a new job immediately or reasonably quickly within the local (usual or equivalent commuting distance) area in the same general field of work. The title of the new job may vary by employer, but job tasks and responsibilities will be essentially the same. Except for the aerospace industry pay differential, wages will be same or close to the worker's former pay scale.

2. **Fair** (reemployment probable 4 to 6 months after termination)

A worker will probably be able to find and be accepted for another job in a comparable occupational activity close to the wage of the last job. The new job will usually be found before all benefits have run out. Job hunting will be extensive and intensive, and may require a longer commute than before.

3. **Poor** (reemployment likely to take at least 6 months and may never be possible)

A worker may not be able to obtain another job in his or her usual field for at least six months, if ever. A complete change of occupation may be necessary, along with intensive training/education and learning additional or new skills; change of location may also be required.

The section on Local Labor Market Potential also contains comments relating to labor demand and supply relationships and imbalances.

C. *Possible Alternative Occupations*

In each Brief an attempt is made to provide the job seeker and the job advisor/consultant with the titles of eight or more occupations utilizing much the same skills and knowledge that the worker should have. While some of these jobs would require no training in specific aspects of the new job, other might necessitate a return to school or participation in a vocational training program in order to gain necessary competencies.

D. *Industries in the Area Offering Best Job Potential*

This section is either presented in the form of a general statement on the labor market possibilities known to exist, along with the names of specific industry groups which usually hire in the occupations, or as a list of industries which utilize the occupation and are expected to have some openings currently or in the near future occurring from either expansion or attrition.

E. *Suggested Training for Increasing Employability*

The courses listed are related to the possible alternative occupations listed in the section on Alternative Occupations, as well as in response to known preferences of potential employers. The training programs have been rated as follows:

1. Time or Duration of Training: one to six months
   Type: OJT, Refresher, Additional skills needed to increase employability in same occupation.

2. Duration: 6 months to 18 months
   Type: Upgrade, New and Additional skills to increase employability in same or different job by adding to skill level and knowledge.

3. Duration: 18 months plus
   Type: New Skills, Intensive Upgrading, Apprenticeship, Vocational Programs, Community College Vocational Preparation, University (degree) to change occupation by extended and intensive training/education.

The information in the Briefs is summarized on Table IV.

ACCOUNTING CLERK

A. ***Job Description:***

Performs a combination of routine calculating, posting, and verifying primary financial data for use in maintaining accounting records. Posts details of business transactions such as disbursements, pay and expense vouchers, payroll deductions, bills paid and due, checks and claims. Totals accounts; computes and records interest charges, refunds, costs of loss or damaged goods, freight, or express charges, and similar items. May enter items into a computer, and may use a word processor, computer, or electronic typewriter to prepare vouchers, invoices, account statements, payrolls, and other reports and records. May reconcile bank statements and make month-end balances.

B. ***Local Labor Market Absorption Potential in Same Job:***

Good to Fair. Jobs are usually available from normal attrition but some expansion in the occupation is expected. Job seekers must compete with a large supply of new workers, and with unemployed workers with similar skills. It is essential that job seekers know and are able to use computers and word processors and bookkeeping machines, and be well versed in overall office procedures.

C. ***Possible Alternative Occupations:***

- Receptionist
- Statistical Clerk
- Customer Service Representative
- Payroll and Timekeeping Clerk
- General Office Clerk
- Medical Records Technician
- Tax Preparer
- Mailing Machine Operator
- Order Clerk
- Reservation Clerk, Hotel
- Reservation Clerk, Transportation
- Cashier
- Bookkeeper

D. ***Industries Offering Best Job Potential:***

Since most larger firms hire accounting clerks, the best job potential will be in those industries expecting to expand their overall employment. These include printing and publishing, trucking and warehousing, water and air transportation, communications and utilities, restaurants, business services, drug and chemical manufacture, and computer hardware and software production.

E. ***Suggested Training for Increasing Employability:***

Courses in :
1. Use and application of computers and word processors
2. Use and application of various office machines
3. Communications, written and oral
4. Refresher, upgrading in office procedures
5. Advanced accounting
6. Tax preparation

AIRCRAFT MECHANIC

A. *Job Description:*

Services, repairs, and overhauls aircraft and aircraft engines to ensure airworthiness. Repairs, replaces, and assembles parts of aircraft using tools such as welding equipment, rivet guns, drills, and power shears. Consults manufacturers' and maintenance manuals for specifications. Examines engines and other parts for cracks, leaks, and sounds of malfunction using a variety of testing devices. Replaces or repairs damaged components, using hand tools, gages, and testing equipment. Disassembles and inspects parts; replaces or repairs components; reassembles and installs engine in aircraft. Inspects, services, and repairs pneumatic and hydraulic systems. May service aircraft. May be required to be licensed by the Federal Aviation Administration.

B. *Local Labor Market Absorption Potential in Same Job:*

Poor. Major increase in hiring or rehiring by aerospace companies is not likely in the near future. Best possibilities will be with the major airlines with maintenance bases in the area. The large supply of available workers will present keen competition. Workers may have to relocate to find jobs.

C. *Possible Alternative Occupations:*

- Field Service Representative
- Flight Engineer
- Reclamation Worker
- Engine Tester
- Forge Shop Mechanic
- Farm Equipment Mechanic
- Oil Field Equipment Mechanic
- Airplane Inspector
- Mechanic, Field and Services
- Auto Mechanic
- Robotics Mechanic
- Maintenance Mechanic, Ship & Boat
- Composing Room Machinist
- Environmental Control System Installer/ Servicer

D. *Industries Offering Best Job Potential:*

- Air Transportation
- Transportation Services
- Trucking and Warehousing
- Automobile Repair
- Miscellaneous Repair Services

E. *Suggested Training for Increasing Employability:*

Courses in :
1. Small engine repair
2. Electro-mechanical theory, service and maintenance
3. Automotive engine repair
4. Computer hardware maintenance, service and installation
5. Environmental control systems
6. Robotics

ASSEMBLERS, Electrical & Electronic

A. ***Job Description:***

Assembles electrical and/or electronic equipment, subassemblies, or components, using hand tools, such as pliers, screwdrivers, tweezers, wire cutters, and soldering iron, and equipment such as induction heater and binocular microscope. Classifications are made according to process, component or product worked on. Works from work-orders, wire-prints, schematics, drawings, and verbal instructions. Tends machines, or uses hand tools to secure parts in place; mounts assembled components; connects and routes wires; installs finished assemblies, and performs on-line, go-no-go testing and inspection.

B. ***Local Labor Market Absorption Potential in Same Job:***

Poor to Fair. The job market is and will be limited in aerospace and missile manufacturing. New contracts which may be obtained will not require production workers in large numbers for some time to come. Job replacement potential from attrition is also limited; fewer than ten percent of the workers in the occupation leave the labor force of their own volition.

C. ***Possible Alternative Occupations:***

- Electric Sign Assembler
- Electrical-Control Assembler
- Air Conditioning Coil Assembler
- Welder Assembler
- Solderer, Production Line
- Computer Repair and Service
- Machine Operator
- Robotics Assembler
- Telephone Installer
- Telephone Mechanic
- Coil Winder
- Electronics Utility Worker
- Watch Assembler
- Jewelry Assembler
- Health Equipment (electronic) Servicer

D. ***Industries Offering Best Job Potential:***

Communications and utilities, electronic components and accessories, electrical lighting and wiring equipment, computer and office equipment manufacture, repair, and service; electrical and electronic medical and health equipment and instruments.

E. ***Suggested Training for Increasing Employability:***

Courses in:
1. Communication skills, oral and written
2. Vocational training in machine shop, and machine operations
3. Upgrade in soldering/welding
4. Repair & maintenance of VCRs, FAX machines, & audio-visual equipment
5. Industrial and commercial electrical wiring repair and maintenance

ASSEMBLERS AND FABRICATORS, Non-electrical

A. ***Job Description:***

Fits and assembles finished parts of equipment, subassemblies, or components, using hand tools such as pliers, wire cutters, soldering iron or welding equipment, and microscope, or magnifying lens. May work from blueprints, sketches, diagrams, etc. May fasten parts together. Examines and tests parts for flaws and to check accuracy of fit.

B. ***Local Labor Market Absorption Potential in Same Job:***

Poor. Fewer jobs are expected as employment generally declines in hard-goods manufacturing. Some jobs may be found in small plants and in soft-goods producers; competition will be very great.

C. ***Possible Alternative Occupations:***

- Bench Hand
- Box Spring Maker
- Cake Decorator
- Packager, Hand
- Wireworker
- Laborer, General
- Food Preparer
- Polisher
- Embosser
- Molder Land Caster, Hand
- Production Helper
- Coil Winder

D. ***Industries Offering Best Job Potential:***

- Printing and Publishing
- Rubber and Plastics Manufacture
- Trucking and Warehousing
- Utilities and Communications
- Sanitary Services
- Health Services
- Wholesale Trade
- Chemicals and Drugs Manufacture
- Mattresses and Bed Springs Manufacture

E. ***Suggested Training for Increasing Employability:***

Courses in:
1. Machine operation
2. Food processing and preparation
3. Woodworking
4. Small and household appliance repair, service and maintenance
5. Environmental control and sanitary services

ASSEMBLERS, Precision - Aircraft

A. ***Job Description:***

Assembles machined parts to make precision aircraft and missile assemblies according to specification. Uses hand tools, power tools, and measuring instruments. Selects and measures parts with micrometers, calipers, and verniers to determine specified tolerance. Files and buffs parts to fit. Drills, taps, reams, countersinks, and spot faces bolt holes in parts, using drill press or power drill. Positions and aligns parts, using jigs, fixtures, templates. Bolts and screws parts together. May test operation of assembled units, and inspect, adjust, and repair used precision assemblies.

B. ***Local Labor Market Absorption Potential in Same Job:***

Poor. There is little immediate absorption potential in this occupation. All types of precision assemblers face further layoffs in the near future. Workers are not highly skilled, but should be able to adapt easily to various assembly production processes in other industries if and when jobs open.

C. ***Possible Alternative Occupations:***

- Wirer, Subassembly (office machinery)
- Medical Instrument Assembler
- Candy Maker
- Musical Instrument Assembler
- Bench Hand
- Electric Motor Assembler/Tester
- Watch Assembler
- Solar Fabrication
- Electric Sign Assembler
- VCR Repairer

D. ***Industries Offering Best Job Potential:***

- Jewelry Manufacturing
- Medical Instrument and Equipment
- Office Machinery Manufacturing
- Solar Equipment Assembly and Manufacture
- Aircraft Transportation, Repair and Maintenance
- Computer Components and Equipment Assembly and Repair
- VCR and other Entertainment Equipment Manufacture, Repair, Installation

E. ***Suggested Training for Increasing Employability:***

Courses in:
1) Communication skills, oral and written
2) Electronics components fabrication
3) Solar equipment fabrication
4) Small electrical appliances repair
5) Computer equipment fabrication
6) Household appliance repair and installation
7) Network wiring

ASSEMBLERS, Precision, Electro-Mechanical Equipment

A. ***Job Description:***

Assembles, tests and repairs precision electro-mechanical equipment such as servomechanisms, gear trains, gyros, dynometers, etc., used in computers, electronic instruments, radar, and similar electronic systems. Follows blueprints, diagrams, oral and written instructions. Measures parts to verify conformance to specified tolerances; examines parts for defects; fits parts together and installs them in housing. Connects wires to specified terminals using screwdriver or soldering iron. Test-operates electrical and mechanical assemblies. Dismantles equipment and replaces worn or defective parts.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Good. Competition for jobs will be keen; however, skills and knowledge held by these workers can be put to use in a variety of industries and operations. Workers with good experience and demonstrated efficiency should be able to find jobs relatively easily.

C. ***Possible Alternative Occupations:***

- Electrical Repairer
- Maintenance Electrician
- Electronics Fitter
- Precision Instrument Maker & Repairer
- Office Machine Tester/Repairer
- Electro-Medical Equipment Repairer
- VCR Repairer
- Electro-mechanical Technician
- Electrical & Electronics Components Inspector
- Computer & Related Equipment Fitter
- Inside Meter Repairer
- Audio-Video Repairer
- Radio and Television Mechanic

D. ***Industries Offering Best Job Potential:***

- Light, Heat and Power Companies
- Electrical, Electronics Components Manufacture
- Power Tool Manufacture
- X-Ray Equipment Manufacture, Installation, and Repair
- Office Machine Manufacture
- Large Household Appliance (refrigerators, stoves, etc.) Manufacture, Installation, Repair and Service

E. ***Suggested Training For Increasing Employability:***

Courses in:
1) Upgrade training in electrical and electronics repair, installation and maintenance
2) Blueprint and schematics reading and comprehension
3) Mathematics
4) Record keeping
5) Communication skills
6) Welding and soldering techniques
7) Audio-visual, radio, and television technology

ELECTRICAL & ELECTRONIC EQUIPMENT ASSEMBLERS, Precision

A. ***Job Description:***

Assembles finished parts to make electrical and electronic equipment. Fixes finished parts in position or mounts them on chassis, using hand tools such as screwdriver and pliers. Installs and connects wiring by clamping or soldering. May rivet parts together. May work according to diagram. May wind wire onto bobbins or directly onto cores by hand or machine to make electrical coils. Secures core to holding device, selects required wire, rotates device to wind, cuts wire and removes coil. May assemble micro-electronic equipment using magnifying lens, hand tools, and spot welder. May specialize in assembly of particular type of equipment.

B. ***Local Labor Market Absorption Potential in Same Job:***

Poor. About three-fourths of all this type assembler are employed in high technology-aerospace firms, and job prospects in other industries are very limited, The job does not require a high level of education or long training time, therefore, competition for the few available jobs will be keen.

C. ***Possible Alternative Occupations:***

- Precision Assembler, Metal
- Assembler/Wirer Industrial Equip.
- Electrical Appliance Services/ Preparer
- Electrical Helper
- Assembler, Garments
- Solderer/Brazer
- Cell Assembler, Chemicals
- Air Conditioning Unit Tester
- Central Office Repairer
- Spring Assembler, Furniture & Bedsprings

D. ***Industries Offering Best Job Potential:***

- Chemicals and Drug Manufacture
- Telecommunications Equipment Manufacture
- Power and Light Companies
- Furniture Manufacturing and Repair
- Air Conditioning Equipment Installation and Repair

E. ***Suggested Training for Increasing Employability:***

Course in:
1) Electrical/electronics theory and techniques
2) Small and household appliances repairs
3) Communications, written and oral; literacy and English

COMPUTER OPERATORS

A. ***Job Description:***

Sets and controls electronic computer to process engineering, scientific, business, personnel, or other data according to operating instructions, and program to be used. Loads input, output, and memory units with tapes, disks, etc. Starts operation and observes terminal control display for errors or faulty output. Clears unit at end of run, and records operating time. May operate optical scanning equipment or computers with printing equipment. May type alphabetic or numerical input on keyboard of computer terminal.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair. Efficient, experience, and well-trained operators with wide knowledge of a variety of computers and software programs should be able to find a job in the local area. There is a large supply of operators available, however, so competition will be keen.

C. ***Possible Alternative Occupations:***

- Bank Teller
- Billing Machine Operator
- Bookkeeping Machine Operator
- Word Processing Machine Operator
- Check Writer
- Food Checker
- Photo Typesetter
- Typist-Stenographer
- Coding Clerk
- Medical Records Clerk

D. ***Industries Offering Best Job Potential:***

- Public Utilities
- Medical Institutions
- Printing and Publishing Firms
- Transportation and Transportation Services
- Business and Engineering Services
- Computer Hardware and Software Manufacturers and Sales
- Financial Institutions
- Retail and Wholesale Establishments

E. ***Suggested Training for Increasing Employability:***

Courses in: 1) Refresher/upgrade training in additional "languages" and variety of computers and programs
2) Programming, systems and analysis
3) Upgrade speed and accuracy of operations
4) General office procedures
5) Office machine operation
6) Communication, written and oral

COMPUTER PROGRAMMER

A. ***Job Description:***

Develops and writes natural and artificial language programs to store, locate, and retrieve specific documents, data, and information. Prepares programs to control the automatic processing of data by computer. Works in area of expertise such as business, engineering and scientific, and technical problems, information systems, and process control. In any field, the worker converts a given problem to detailed logical flow charts for coding into computer language. Applies knowledge of computer capabilities and program intent to solve problem and obtain required output. Consults with managerial, professional, technical, scientific, and engineering personnel as needed to determine problems, desired output, and to plan project. Writes detailed logical flow chart into symbolic form to represent work order of data, and to describe input, output, and operation involved. Converts flow chart into language processable by computer. Prepares written instructions and documentation. May write programs for control systems that automate operations.

B. ***Local Labor Market Absorption Potential in Same Job:***

Good. Jobs are usually available for capable people in this field; especially those with engineering and scientific experience, or with a strong business background. Workers who are creative, and innovative, and have a wide knowledge of a variety of computers, computer languages, and computer programs (software) can usually find a job in a relatively short period of time.

C. ***Possible Alternative Occupations:***

- Statistician
- Demographer
- Information Technician
- Tool Programmer
- Programmer, Process Control
- Systems Analyst
- Operations Analyst
- Software Technician
- Customer Support Specialist
- Sales & Demonstration, Computers

D. ***Industries Offering Best Job Potential:***

- Telecommunications
- Multi-media Production Companies
- Market Research
- Business and Engineering Services
- Industrial Consultants
- Air Transportation
- Health and Medical Services
- Legal Services
- Accounting Firms

E. ***Suggested Training for Increasing Employability:***

Courses in: 1) Upgrade training to Systems Analyst
2) Communication skills
3) Statistics
4) Market research
5) Networking

DRAFTERS

A. *Job Description:*

Prepares working drawings from designer's sketches and specifications for engineering, construction, manufacturing or other projects, and prepares charts and drawings for other purposes. Makes necessary calculations of dimensions, surfaces, volumes, and other factors; prepares clear, complete, and accurate working plans and detail drawings from rough sketches or notes; makes final sketch, checking dimension of parts, materials to be used and relation of parts to each other and to whole structure. Makes adjustments and changes as necessary. Uses variety of drafting tools and knowledge of various machines, engineering practices, mathematics, materials, and other physical sciences.

B. *Local Labor Market Absorption Potential in Same Job:*

Poor. Immediate rehire potential is very limited, as there is a relatively large supply of experienced drafters, especially of those with architecture and manufacturing backgrounds. Some jobs may open through attrition.

C. *Possible Alternative Occupations:*

- Technical Illustrator
- Detailer
- Illustrator
- Drafter, Heating & Ventilation
- Cartographer, Detailer
- Furniture, Detailer
- Lithographic Artist
- Electrical Cable Diagrammer
- Graphic Artist
- Landscape Drafter/Designer
- Surveyor, Assistant

D. *Industries Offering Best Job Potential:*

- Government Agencies
- Construction
- Electrical/Electronic Components Manufacture
- Public Utilities
- Printing and Publishing

E. *Suggested Training Courses for Increasing Employability:*

Courses in:
1) Graphic arts and illustration
2) Landscape architecture
3) Communication skills
4) Surveying and map making

ELECTRONIC REPAIRERS

A. ***Job Description:***

Repairs electronic equipment according to product specifications, manufacturing instructions and diagrams, using hand tools and soldering iron. Examines unit to locate defects. Removes broken wires, cuts new wires, solders them to specified terminals. Reroutes and solders color-coded wires to terminals following wiring diagram. Repairs defective parts and removes defective components. Installs new components.

B. ***Local Labor Market Absorption Potential in Same Job:***

Poor. This job is limited by its size -- in many instances the work is performed in a factory by a leadman or electronics technician, or by a precision assembler as part of their assigned tasks. In small repair shops, or factories where products are repaired on recall or complaint, there may be a single individual responsible for the work.

C. ***Possible Alternative Occupations:***

- Field Engineer
- Production Repairer
- Electronic Sales and Service
- Electronic Mechanic
- Television and Radio Repairer
- Audio-Visual Repairer
- Electrical Appliance Repairer
- Electrical Tool Repairer

D. ***Industries Offering Best Job Potential:***

- Electrical/Electronic Goods Sales and Service
- Television and Radio Sales and Service
- Household Appliance Sales and Service
- Computer Components Manufacturing
- Office Machine Repair Shops
- Electrical/Electronic Medical Equipment and Instruments Repair

E. ***Suggested Training for Increasing Employability:***

Courses in:
1) Sales
2) Computer repair and installation
3) Appliance maintenance, repair, and service
4) Audio-visual equipment, repair, and service
5) Communications, oral and written
6) Record keeping

ENGINEERS, Aircraft and Aerospace

A. ***Job Description:***

This title covers a group of occupations concerned with design and development of aircraft, space vehicle, missiles, weapons, and related systems. An aircraft or aerospace engineer: Designs, develops, and tests aircraft, space vehicles, surface effect vehicles, and missiles, space probes, and related systems applying engineering principles and techniques. Designs and develops military and/or commercial aircraft and related hardware or systems. Establishes computational methods and computer input data for analyzing problems. Tests models, prototypes, or subassemblies. May specialize in design and development of a specific structural component or operational control system. May specialize in analytical programs concerned with ground or flight testing or development of acoustic, thermodynamic, or propulsion systems. Formulates and evaluates test programs. Prepares reports and conclusions for other engineering and design personnel.

B. ***Local Labor Market Absorption Potential in Same Job:***

Poor. Almost all aircraft and aerospace engineers are employed in the two industries classified as aerospace. The only openings expected will be from attrition -- retirement, death, and labor force withdrawal of employed workers. While some companies will hold onto their best engineers as long as possible, it is likely that further cutbacks will occur. Best chances may be in location change, or by broadening of expertise and knowledge.

C. ***Possible Alternative Occupations:***

- Hydraulics Engineer
- Sanitary Engineer
- Power Distribution and Transmission Engineer
- Methods Engineer
- Waste Treatment/Pollution Control Engineer
- Product Engineering Technician
- Power Generation Engineer
- Heating, Ventilating, and Refrigeration Engineer
- Traffic Planner
- Salesperson/Field Representative, Engineering Services

D. ***Industries Offering Best Job Potential:***

- Heating and Ventilating Equipment Manufacturing
- Air Transportation/ Airline Servicing and Repair
- Waste Treatment/Pollution Control
- Engineering Services
- Electronics Manufacturing

E. ***Suggested Training for Increasing Employability:***

Courses in:
1) Mechanical engineering upgrade and refresher
2) Bioengineering and biomedical engineering
3) Electro-mechanics instrumentation and maintenance technologies
4) Environmental control technology
5) Audio-visual technology

ENGINEERS, Electrical and Electronics

A. ***Job Description:***

Carries on research on electrical and electronics problems; designs and advises on electrical and electronic systems and equipment. Plans and supervises development, construction, installation, operation, maintenance, and repair of electrical and electronic equipment. Studies operating requirements for electrical power generation and distribution equipment, industrial and domestic electrical machinery and appliances and other electrical equipment. Studies operating requirements for radio, television, and radar equipment, telecommunication, automatic control and guidance systems and other electronic equipment. Engages in research and development work; consults with specialists as necessary; designs systems and equipment, prepares working drawing and specification; estimates costs of labor and materials; supervises installation and checks completed work to ensure compliance with specification and safety standards.

B. ***Local Labor Market Absorption Potential in Same Job:***

Good. Prospects for relatively rapid reemployment are well above average. Electrical/electronics engineers with broad experience and good qualification are always in demand.

C. ***Possible Alternative Occupations:***

- Systems Engineer
- Commercial Engineer
- Planning Engineer, Central Office
- Illuminating Engineer
- Field Service Representative
- Power System Engineer
- Systems Development Specialist
- Solar Energy Systems Designer
- Customer Equipment Engineer
- Nuclear Plant Technical Advisor

D. ***Industries Offering Best Job Potential:***

- Electronic Components Manufacture
- Computer and Accessories Manufacturing
- Power and Light Producers
- Electro-Optical Systems Manufacturing
- Petro-Chemical Companies
- Solar Energy Components Manufacturing and Installation
- Biomedical Components and Equipment Manufacturing
- Electrical Lighting and Wiring Producers
- Audio-Video Equipment/Components

E. ***Suggested Training for Increasing Employability:***

Courses in:
1) Bioengineering and biomedical technologies
2) Quality assurance/quality control technologies
3) Occupational safety and health technologies
4) High definition television technology

ENGINEERS, Industrial

A. ***Job Description:***

Studies, advises on, and implements methods to promote the efficient, safe, and economic utilization of personnel, materials, and equipment. Plans utilization of production facilities and personnel to improve efficiency of operations. Studies functional statements, organization charts, and project information to determine functions and responsibilities of various workers and work units; identifies overlap, establishes work measurement programs, and develops standards of output. Supervises time and motion studies, makes recommendations to promote efficiency and supervises their implementation. Analyzes and coordinates study and observation data, and initiates or recommends changes in organization, work procedures, manufacturing processes and methods, machine utilization, space layout or work units and job duties.

B. ***Local Labor Market Absorption Potential in Same Job:***

Good. Although three out of four industrial engineers at work in the Los Angeles area are employed by high technology and aerospace firms, the employment level has remained relatively stable. Restructuring of companies and plant mergers often require the use of industrial engineers to help increase efficiency and cuts costs, as administrative and executive staffs work to make their operations "leaner and meaner". Other manufacturing plants, as well as large commercial organizations, can also be expected to increase employment in this category as they too tighten up on the outgo, and stress production and profits.

C. ***Possible Alternative Occupations:***

- Product Safety Engineer
- Standards Engineer
- Director, Quality Control
- Factory Lay-Out Engineer
- Management Analyst
- Program Specialist, Health Maintenance
- Production Planner
- Safety Manager
- Time-Study Engineer
- Public Health Engineer
- Pollution/Waste Management Analyst/Engineer

D. ***Industries Offering Best Job Potential:***

All large organizations usually hire workers in this classification. Best opportunities should be in engineering and management services, biomedical equipment manufacturing, motion picture industry, air transportation, city and county government, health and medical institutions.

E. ***Suggested Training for Increasing Employability:***

Courses in:
1) Environmental health technology and engineering
2) Waste management and pollution control
3) Urban planning technology
4) Laser/electro-optics technology

GENERAL OFFICE CLERKS

A. ***Job Description:***

Performs a variety of clerical tasks depending on nature and size of office in which employed. Compiles and maintains records of business transactions and office activities. Copies data and compiles records and reports. Tabulates and posts data in record books. Examines incoming mail, assembles information needed for replies to correspondence. Collates sales records, receives and interviews callers, arranges appointments and directs inquiries and visitors to appropriate person or department. Receives payments and issues receipts. Files office documents and correspondence. Adjusts complaints. Operates office machines; may type reports and correspondence. May prepare payroll. May keep books and inventory of supplies.

B. ***Local Labor Market Absorption Potential for Same Job:***

Fair to Good. Over 100,000 people are employed in this occupation in Los Angeles County; therefore, job vacancies are constantly occurring from turnover and attrition, as well as new business increments. Some expansion may be expected as well in the non-manufacturing industries.

C. ***Possible Alternative Occupations:***

- Receptionist
- Information Clerk
- Hotel Desk Clerk
- Medical Records Clerk
- Ticket/Reservation Clerk
- Postal Service Clerk
- Cashier
- Teller
- Travel Agent
- Dispatcher, Police, Fire Department, Transportation
- Customer Service Representative

D. ***Industries Offering Best Job Potential:***

Almost all employing establishments hire workers in this category. Best opportunities should be in electronics and components manufacture, trucking and warehousing, air transportation, communications and utilities, financial institutions, medical and other health organizations, business services, and accounting and management services.

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Advanced secretarial training
2) Computer operations/languages
3) Communications skills, oral and written
4) Office machine operations
5) Medical terminology/records keeping
6) Bookkeeping/accounting

GENERAL SECRETARY

A. ***Job Description:***

Carries out minor administrative and general office duties in addition to taking and transcribing dictation. Takes dictation by shorthand, machine or from record. Types and records oral and written matter, utilizing typewriter, word processor, or other transcription equipment. Makes appointments, and schedules meetings; deals with inquiries and answers and makes telephone calls on business matters. Opens and reads, or passes mail to superior, and deals with routine correspondence on own initiative. Takes care of special files. May act as receptionist, and refers callers to appropriate person or department. May compile and type statistical reports. May keep personnel records. May operate a variety of office machines and send and receive "fax" reports and mail. May supervise other clerical staff.

B. ***Local Labor Market Absorption Potential in Same Job:***

Good. Expert, efficient, responsible, and experienced secretaries are always in demand. Competition may be keen, and job changes sometimes involve starting at a lower pay rate than before, or being willing to commute longer distances to work.

C. ***Possible Alternative Occupations:***

- Court Reporter
- Administrative Assistant
- Customer Service Representative
- Information Clerk
- Ticket/Reservation Clerk
- Legal Secretary
- Medical Secretary
- Office Manager
- Payroll Clerk
- Sales Correspondent
- Travel Agent
- Hospital Admittance Clerk

D. ***Industries Offering Best Job Potential:***

Jobs may be found industry wide. Best immediate opportunities should be in electronics, computer hardware and software products, business services, legal services, medical and hospital offices, communications and utilities, printing and publishing.

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Computer science and application
2) Medical transcription/terminology/technology
3) Legal transcription/terminology
4) Word processing
5) Accounting/bookkeeping
6) Interpersonal skills
7) Business administration/supervision and management
8) Paralegal aide

MACHINIST

A. *Job Description:*

Sets up and operates machine tools: fits and assembles parts to make and repair machine tools, metal parts or mechanisms. Reads and applies instructions from blueprints, sketches or written orders. Determines dimensions and tolerances of pieces to be machined, decides sequence of operations, and tools, materials, and machines required. Sets up and operates machines; verifies conformance to specifications, using measuring machines. Uses hand tools to fit and assemble parts. Observes operation; may test with inspection equipment. May develop specifications from general description and draw or sketch product to be made. May do flame cutting and gas or arc welding. General machinists have usually completed a four-year formal apprenticeship.

B. *Local Labor Market Absorption Potential in Same Job:*

Fair to Good. While employment opportunities may be limited in some manufacturing industries, expert machinists should be able to find jobs in smaller machine shops. Some job openings will be available through attrition since workers in this occupation are likely to be in the upper age groups.

C. *Possible Alternative Occupations:*

- Maintenance Mechanic
- Machine Repairer
- Form Builder
- Major Assembly Inspector
- Gunsmith
- Experimental Mechanic
- Machinist, Automotive
- Oil Field Equipment Mechanic
- Manufacturer's Service Representative
- Sales Representative, Machine Tools
- Precision Instrument Maker

D. *Industries Offering Best Job Potential:*

- Small Machine Shops
- Automotive Repair Shops
- Transportation (Services to)
- Manufacturer's Warehouse
- Machine Repair and Service
- Communications and Utilities

E. *Suggested Training for Increased Employability:*

Dependent on age and interests of individual, vocational courses could include:

1) Sales
2) Communications, written and oral
3) Management and supervision
4) Electronic theory and technology

MANAGERS, Engineering, Mathematics, Science

A. ***Job Description:***

Directs, coordinates, and exercises functional authority for planning, organization, control, integration, and completion of engineering, data processing systems, research and development, and for scientific projects and activities of a department of an establishment or organization. Works within general policy laid down by top management and consults with general manager and other department heads relating to development of new or improved processes, products, utilization of personnel and/or different materials. Plans and formulates aspects of proposals and contract requests. Develops and implements methods and procedures for manufacturing operation and processes, engineering, planning, sales, and maintenance or research and development to effect operational efficiency and economy. Reports to executive body on work of department.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Good. Job attainment in the local area in a relatively short time period depends strongly on expertise, reputation, qualifications, and experience of the job seeker. Restructuring of larger plants and cost awareness are factors in how many jobs may be open. About half of all jobs in this classification are in the high technology-aerospace industries, and little expansion is expected from that source. Job seekers should be willing to move, change industries, and/or commute longer distances in order to obtain work.

C. ***Possible Alternative Occupations:***

- Operations Manager
- Production Manager
- Contract Administrator
- Manager, Electronic Data Processing
- Manager, Solid Waste Disposal
- Manager, Warehouse
- Proposal Writer
- Project Engineer
- Director, Research & Development
- Environmental Analyst
- Technical Director
- Business Consultant

D. ***Industries Offering Best Job Potential:***

- Communications and Utilities
- Power and Light Companies
- Chemicals and Drugs Manufacturing
- Consulting Firms
- Engineering and Management Services
- Fiber Optics Production and Equipment Manufacturing
- Environmental Agencies
- Waste Management/ Pollution Control Establishments
- Research & Development Organizations
- Computer Soft/Hardware Production

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Interpersonal skills
2) Communications
3) Fiber optics technology
4) Nuclear & other waste mgmt.
5) Management and supervision

MANAGER, Industrial Products

A. ***Job Description:***

Plans, organizes, directs, and controls the activities of the production department of an industrial products manufacturer. Participates in formulating production policy; draws up production program according to policy decisions of the general manager or executive officer. Estimates and verifies number, kinds, amounts, quality, etc., of labor, materials, and equipment needed. Controls through subordinates the organization of work and coordinates the activities of the production department. Consults with departmental managers about financing, materials, supplies, worker needs and costs, marketing and distribution. Formulates time and cost estimates; makes decisions and recommendations regarding plant equipment and maintenance, Devises procedures for inspecting and reporting production results. Prepares and presents reports to executive staff. May negotiate wage-setting and working condition questions.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Good. The best source of jobs will be from attrition of older workers in this classification. Competition will be keen with workers from other areas actively competing for local openings. About one-third of all workers in the occupation are now employed in high technology-aerospace manufacturing firms; there will be considerable job insecurity within those firms retaining such manager positions. However, restructuring and merging of plants will create some new job opportunities, as the affected firms will search for experts in the field.

C. ***Possible Alternative Occupations:***

- Superintendent of Works
- Manager, Bulk Plant
- General Supervisor
- Hospital Administrator
- Project Engineer
- Traffic Analysis/Coordinator
- Manager, Food Processing
- Manager, Operations
- Business Manager
- Research-Contracts Supervisor
- Safety Coordinator
- Maintenance Superintendent

D. ***Industries Offering Best Job Potential:***

- Chemical/Drugs Production
- Food Processing
- Biomedical Equipment Production
- Computer Hard/Software Production
- Business Management Consulting
- Trucking/Warehousing
- Public Utilities
- Telecommunications Equipment Production

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Personnel management
2) Institutional management
3) Marketing and distribution
4) Management international business

NUMERICAL CONTROL OPERATORS

A. *Job Description:*

Sets up and operates magnetic or punched tape controlled machine tools that automatically mill, drill, broach, and ream metal parts. Follows set-up specifications to determine sequence of operations and dimensions of finished work-piece. Positions and secures work-piece on machine table, using measuring and hand tools. Assembles required cutting tools in toolholders and positions in machine spindles. Places control tape or punch card in reader of control console, sets stops to control length of stroke and depth of cut. Starts machine. Observes operation, and verifies accuracy of machined work-piece against blue prints or engineering drawings; reports programming inaccuracies. May adjust machine feed and speed, and change cutters.

B. *Local Labor Market Absorption Potential in Same Job:*

Poor. As employment in large aerospace firms declines, fewer job opportunities will be available. Supply of experienced and qualified workers will be more than sufficient to meet employer needs over the next year or so.

C. *Possible Alternative Occupations:*

- Inspector, Set-up and Lay-out
- Machine Operator, Metal
- Peripheral EDP Equipment Operator
- Gunsmith
- Metal, Plastic Machine Setter
- Packaging, Filling Machine Operator
- Computer Programmer Aide
- Precision Assembler
- Locksmith
- Numerical Control Process Programmer

D. *Industries Offering Best Job Potential:*

- Machine Shops
- Subassembly Plants
- Machine Tool Manufacture
- Computer Hardware Manufacture

E. *Suggested Training for Increased Employability:*

Courses in:
1) Computer technology
2) Gunsmithing
3) Lock making
4) Computer programming
5) Machine tool operation

OPERATIONS & SYSTEMS RESEARCHERS & ANALYSTS

A. ***Job Description:***

Conducts logical analyses of management problems and formulates mathematical models of each problem for programming and solution by computer. Analyzes problem and makes decision to ensure maximum probability of profit, or effective result, in relation to financial costs or inputs; prepares mathematical model, assembles data, directs data preparation, and tests model. Prepares report describing problem solution, or showing ranking of different alternatives according to desirability and probability of success. May develop and apply time and cost techniques to plan and control large scale projects. May do research on and preparation of contract proposals.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Good. This occupation, while small in volume, is quite essential for firms dealing with government contracts, esoteric research or innovative manufacturing technologies. Because the supply of experienced and competent workers is also limited, the job search should be successful, but may take some time as well as a change of industry and location.

C. ***Possible Alternative Occupations:***

- Market Research Analyst
- Mathematician
- Test Technician
- Engineering Analyst
- Statistician, Applied
- Computer Applications Technician
- Specifications Workers
- Teacher, Computer & Science
- Programmer, Engineering & Scientific

D. ***Industries Offering Best Job Potential:***

- Any Large Manufacturing Firm
- Air Transportation
- Communications and Utilities
- Engineering and Management Consulting Services

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Industrial technology
2) Quality assurance/quantity control technology
3) Measurement, testing, and safety technologies
4) Teacher education
5) Communications, written and oral

PRECISION INSPECTORS

A. ***Job Description:***

Inspects finished products or parts for conformance to manufacturer's standards, finish, and appearance. Examines product for accuracy of assembly and completeness; inspects for defects, such as dirt, blisters, color variation, faulty alignment, goodness of connection, and/or surface defects. Measures or weighs product for conformity to specifications and to verify dimensional accuracy, using weighing scales, gauges, ruler, micrometer, and various test instruments. Connects accessories and equipment to instruments such as voltmeter, ammeter, oscilloscope, and tests for voltages, output and input of power, electrical leakages, short and open currents. Adjusts moving parts. May repair certain flaws. May operate fluoroscope, x-ray, or magnaflux machine to examine internal defects. Records results of tests.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Poor. About sixty percent of all workers in this category are employed in the high technology-aerospace industries. Since further declines are expected in that group, any vacancies will be subject to extreme competition. Most of these workers obtain their jobs through upgrading from production inspector or machine operator.

C. ***Possible Alternative Occupations:***

- Quality Control Inspector/Tester
- Inspector, Optical Goods
- Gas Meter Tester
- Solar Heating & Cooling Technical Aide
- Complaint Inspector
- Assembler, Bench
- Checker
- Inspector, Office Machine
- Weigher/Mixer, Chemical and Drugs

D. ***Industries Offering Best Job Potential:***

Most manufacturing industries hire precision inspectors for quality control. Best job prospects should be in:

- Electronics Components
- Computer Components and Accessories
- Office Machine Manufacture
- Chemical and Drugs Manufacture
- Telemetry Products Manufacture

E. ***Suggested Training for Increased Employability:***

Courses in:
1) High school or equivalency
2) Communication skills, written and oral, with emphasis on spoken English
3) Electrical/electronic technology
4) Laser electro-optics technology
5) Sanitation operations and processes

PRODUCTION INSPECTORS, SORTERS, SAMPLERS & WEIGHERS

A. ***Job Description:***

Inspects materials and assemblies using manufacturing components or finished products for conformity to specifications using fixed or preset measuring instruments. Examines parts and materials for cracks, flaws, corrosion, dents, spoilage, color, size, condition, or other defects. Verifies stock size, material, and code marking for conformity with drawings, specifications, and quality and quantity standards. Measures dimensions and contour or weighs product to determine conformity to requirements, using scales, calipers, micrometers, dial indicators, and gages. Verifies configuration of assembly components; compares locations, thickness, and smoothness of joined parts with samples. Connects equipment to testing devices and observes mechanical operation of parts and machine. As necessary, checks electrical connections and quality of units. Rejects faulty production. Records information on inspection ticket. May repair certain flaws.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Good. Most producers of manufactured goods, components or finished products ranging from audio and video equipment producers to women's and children's clothing use workers in this classification. The job may vary from simple sorting of items into acceptable and rejects to fairly complicated testing and verifying of conformance and performance. Adaptability to a variety of inspection tasks provides the best opportunity for quick job attainment. Turnover is also heavy, so the job search should be reasonably short, if the worker is willing to accept a different activity and change of location, along with a longer commute to work.

C. ***Possible Alternative Occupations:***

- Quality Control Technician
- Pantry Worker
- Inspector and Sorter
- Utility Worker, Line Assembly
- Machinery Fitter
- Checker
- Sample Tester
- Scaler-Packer
- Collator, Hand
- Still & Reactor Operator
- Jewel Gager
- Utilities Services
- Laboratory Assistant

D. ***Industries Offering Best Job Potential:***

Almost every manufacturing firm hires workers in this occupation. Best potential should be in:

- Electronics
- Metal Fabrication
- Precision Optical Goods
- Medical Appliances
- Food Processing and Packing
- Plastics and Synthetics
- Communications Equipment

E. Suggested Training for Increased Employability:

Courses in:
1) English - grammar, reading and speaking
2) Communications, written and oral
3) Laboratory technology
4) Energy, power and transmission theory and maintenance

PRODUCTION PLANNING & EXPEDITING CLERK

A. ***Job Description:***

Prepares or assists in preparing production operations schedules, using data from customers' orders and information on production capacity and performance. Compiles and maintains production records and reports on such items as materials and parts used, products produced, frequency of defects; expedites flow of work and materials; receives, stores, issues, requisitions, and accounts for materials and goods. Calculates the amounts of materials needed for production programs, to ensure availability. Draws up production schedules taking account of demand and production capacity. Verifies availability of stocks or arranges deliveries. Investigates delay and initiates remedial action. Prepares reports on progress of actual production performance from examination of work tickets or other control data.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Good. This is a relatively large volume occupation -- nearly 17,000 workers are employed in the occupation in Los Angeles County, and about two-thirds of these work in industries other than high technology-aerospace, allowing for a fairly strong and steady demand.

C. ***Possible Alternative Occupations:***

- Material Coordinator
- Production Scheduler
- Control Clerk
- Stock Clerk
- Estimator, Printing
- Storage Facility Rental Clerk
- Industrial Order Clerk
- Order Fillers
- Counter Clerk
- Dispatcher
- Scheduler, Museum
- Vending Machine Attendant

D. ***Industries Offering Best Job Potential:***

Best possibilities should be in:
- Warehousing and Storage
- Wholesale Trade Establishments
- Chemical or Drug Manufacturers
- Communications and Utilities
- Hospitals/Medical Institutions
- Apparel Manufacturing

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Computer applications, especially business data processing
2) General office procedures
3) Marketing management
4) Accounting
5) Traffic, rates, and transportation operations

PURCHASING AGENT

A. ***Job Description:***

Buys machinery, equipment, raw materials, supplies and services for use or consumption necessary for the operation of an organization. Determines requirements, reviews requisitions, studies trade periodicals, suppliers' literature, and other market information on varieties, qualities, and prices. Selects purchase items by testing, observing, and examining. Reviews bid proposals from vendors and negotiates and enters into contracts within budget limitations. Keeps records of costs, deliveries, and performance. Takes corrective action as necessary on defective merchandise or poor services. May approve bills for payment.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Poor. Current supply is larger than demand. Further layoffs are expected as organizations are restructured, and the number of management support jobs is reduced. Some openings will result from attrition since some workers in the occupation are of, or close to, retirement age.

C. ***Possible Alternative Occupations:***

- Buyer
- Purchasing Agent, Farm Products
- Tooling Coordinator
- Purchase-Price Analyst
- Contract Specialist
- Manager, Contracts
- Manager, Procurement
- Property Disposal

D. ***Industries Offering Best Job Potential:***

- Wholesale Farm Products
- Retail Trade Establishments
- Warehousing and Storage
- Air Transportation
- Government Agencies
- Health Care Administration
- Import/Export Organizations

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Public works, e.g., sanitation, transportation, public utilities
2) Computer and information products manufacturing and services
3) International marketing
4) Business management analysis services

SHEET-METAL WORKERS

A. ***Job Description:***

Makes, installs, and repairs a variety of sheet-metal articles by hand and machine, according to job order or blueprint. Selects gage and type of sheet-metal according to product being fabricated, marks dimension and reference lines as directed by drawings and other specifications. Sets up and operates fabricating machine to cut, bend, and straighten the metal piece. Sets up and operates soldering and welding equipment to join and seal parts. Shapes metal; punches or drills holes for rivets, bolts, and screws; assembles parts, caulks seams and trims edges; installs and repairs sheet-metal articles. Inspects assemblies and installation for conformance with specifications.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Poor. Most job openings in the near future will be to replace attrition. Most of the large firms hiring in this occupation are reducing production staff. However, some jobs may open in firms doing air conditioning and heating and ventilation work, and small shops making items like electric signs.

C. ***Possible Alternative Occupations:***

- Roofer, Metal
- Shop Mechanic
- Boiler Maker
- Welder, Solderer
- Shaping Machine Operator
- Sheet Metal Installer
- Metal Fabricator
- Ornamental Metal Worker
- Bench Hand
- Former, Hand
- Shear Operator
- Metal Fabrication Shop Helper

D. ***Industries Offering Best Job Potential:***

- Construction
- Heating and Ventilating Installation and Repair
- Metal Fabricating Shops
- Machine Shops
- Musical Instruments Manufacture
- Utilities -- Light, Heat, and Power
- Foundries

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Heating, ventilating, air conditioning
2) Refrigeration
3) Industrial equipment maintenance and repair
4) Stationary energy sources, e.g. pumping plant installation, operation and maintenance
5) Upgrade in metal fabrication and pattern making

STOCK CLERKS

A. ***Job Description:***

Receives, stores, and issues equipment, materials, supplies, merchandise, foodstuffs, or tools, and compiles and maintains stock records. Controls and arranges receipt and dispatch of goods and materials; counts, sorts, or weighs incoming articles to verify receipt of items on requisition or invoices. Stores articles in bins, on floor, or shelves according to style, size, or type of material. Fills orders or issues supplies from stock. Prepares and keeps inventory of stock; requisitions additional or new items to replenish stock; checks on spoilage or damage. May mark items with identifying codes, figures, or letters. may cut stock to required size. May move or transport materials to other departments.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Poor. Worker supply is large relative to demand. Best job chances will be from openings made available by attrition. Most industrial establishments use stock clerks or assign the tasks to other workers as part of their duties.

C. ***Possible Alternative Occupations:***

- Cargo Agent (Air Transportation)
- Laborer, Stores
- Tool Crib Attendant
- Dispatcher (Construction)
- Linen Room Attendant (Hotel, Restaurants, Hospital)
- Load Checker (Light, Heat, & Power)
- Mailer (Print & Publishing)
- Food & Beverage Checker (Hotels & Restaurants)
- Pharmacy Helper
- Supply Clerk
- Property Custodian (Motion Pictures)
- Order Caller
- Laboratory Sample Carrier
- Meter Reader
- Sorter - Pricer
- Material Coordinator

D. ***Industries Offering Best Job Potential:***

- Restaurants & Hotels
- Retail Trade (Groceries & Department Stores)
- Wholesalers & Warehousing
- Medical & Health Services
- Lumber & Wood Products
- Special Trade Contractors (Construction)
- Chemical, Drugs, Synthetics Manufacturing

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Bookkeeping and accounting
2) Procurement and purchasing
3) Systems efficiency
4) General office skills
5) Computer applications
6) Communication skills, written and oral

SYSTEMS ANALYSTS

A. *Job Description:*

Analyzes data processing needs and problems of client or employer. Advises on feasibility of automatic data processing and develops appropriate systems and procedures. Formulates mathematical models of systems and sets up and controls computer system to solve problems. Ascertains specific output requirements, such as items to be identified, degree of summarization permitted, and format for presentation of results. Specifies in detail logical and/or mathematical problems to be performed by various equipment units and/or comprehensive computer programs, and operations to be performed by personnel in system. Conducts practical trials to verify suitability of results. May prepare programs for computer use. Prepares technical reports; develops new techniques; writes instructional manuals.

B. ***Local Labor Market Absorption Potential in Same Job:***

Good. Expert systems analysts with broad experience should be able to find employment in a relatively short time. Demand is constant and widespread among industries.

C. ***Possible Alternative Occupations:***

- Operations Research Analyst
- Statistician
- Computer Programmer
- Consultant, Information Systems
- Teacher, Computer Science
- Sales Representative, Computer Soft/Hardware
- Records Manager
- Information Scientist
- Actuary
- Software Technician
- Programmer, Process Control
- Financial Analysis

D. ***Industries Offering Best Job Potential:***

- Financial Institutions
- Government Agencies
- Engineering Firms and Consultants
- Communications/Utilities Companies
- Health Services
- Insurance Companies
- Security and Commodity Brokers
- Air Transportation
- Schools
- Business Management Consultants
- Computer Software Producers

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Communication skills, written and oral
2) Interpersonal skills
3) Sales
4) Refresher course in mathematics and statistics
5) Upgrade in additional/new computer hard/software and languages
6) Networking

TECHNICAL WRITERS

A. ***Job Description:***

Designs and writes manuals, brochures, handbooks, and similar technical publications. Examines available pertinent information, studies information provided by and consults with professional, scientific, and technical personnel concerning installation, operation, maintenance, and repair of specialized equipment. Designs and writes manuals, brochures, handbooks or similar technical publications in a form readily intelligible to intended readers. Directs preparation of photographs, technical drawings, sketches and other illustrative material for inclusion in published product. May write speeches, articles, and public or employee relations releases. May assist in preparation and writing of proposals, training guides, work methods and procedures.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair to Good. Experienced and competent technical writers are at a premium, but the number of jobs available is very limited. The job hunt could be extended and intensive.

C. ***Possible Alternative Occupations:***

- Publicity Writer
- Continuity/Script Writer (Radio/TV)
- Editorial Assistant
- Copy Reader, Writer
- Sales-Service Promoter
- Specification Writer
- Sub-editor, Publishing
- Writer, Editor Technical Publications
- Public Relations Assistant
- Advertising Copy Writer

D. ***Industries Offering Best Job Potential:***

- Printing & Publishing
- Advertising Firms
- Radio & TV Broadcasting
- Business Management Consultants
- Training Program Specialists
- Text Book Publications
- Government Agencies
- Research and Development Organizations

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Advanced creative writing
2) Communication technology
3) Journalism
4) Advertising
5) Public relations
6) Writing, technical and commercial
7) Radio/TV broadcasting, general

TECHNICIANS AND TECHNOLOGISTS, Electrical and Electronic

A. *Job Description:*

Performs technical tasks, normally under the direction and supervision of electrical/electronics engineers, contributory to the design, development, construction, installation, maintenance, and repair of electrical/electronic systems, devices, and equipment. Sets up and carries out experiments, makes tests and observations, takes readings, performs calculations, adjusts instruments, and otherwise assists in research and development work in either electrical or electronic areas. Prepares detailed estimates of quantities and costs of materials and labor required; prepares work schedules; exercises technical supervision, guidance and control. Inspects and tests completed work.

B. *Local Labor Market Absorption Potential in Same Job:*

Good. This is one of the largest volume occupations in the study. About 25,000 workers are employed in the County in this classification, and prospects are for some growth or at least, stability, which will provide many jobs from normal attrition, alone. Workers with good experience and acceptable references should be able to transfer to another similar job in a relatively short time.

C. *Possible Alternative Occupations:*

- Instrumentation Technician
- Calibration Laboratory Technician
- Technical Testing Engineer Asst.
- Quality Control Technician
- Test Technician
- Reliability Engineering Assistant
- Electrician, Research
- Pollution Control Technician
- Test-Engine Evaluator
- Utilization Engineering Assistant

D. *Industries Offering Best Job Potential:*

- Electronics Components and Accessories Manufacturing
- Audio-video Component Manufacturing
- Fiber Optics Production
- Computer Hardware and Accessories Manufacturing
- Scientific/Medical Electric/Electronic Instrument & Equipment
- Communications Equipment
- High Definition Television Technology

E. *Suggested Training for Increased Employability:*

Courses in:
1) Communications, written and oral
2) Supervision and management
3) Computer equipment construction
4) Telecommunications technology
5) Networking technology
6) Television technology

TECHNICIANS AND TECHNOLOGISTS, Mechanical Engineering

A. ***Job Description:***

Develops and tests machinery and equipment, applying knowledge of mechanical engineering technology, under the direction and supervision of engineering and scientific staff. Sets up and carries out experiments, makes tests, performs calculations, and drafts detailed drawings or sketches for drafting room completion. Devises, fabricates and assembles new or modified mechanical components or assemblies. Prepares detailed estimates of quantities and costs of materials and labor. Prepares work schedules, exercises technical supervision and control. Inspects and tests completed work; modifies or adjusts equipment to meet specifications. Records test procedures and results.

B. ***Local Labor Market Absorption Potential in Same Job:***

Fair. Approximately one-half of all jobs in this category are found in the high technology-aerospace industries; therefore, job opportunities will be limited, despite the high skills and varied knowledge of the holders of the occupation. Best possibilities will be in electronics applications of all types, and in computer hardware and software production.

C. ***Possible Alternative Occupations:***

- Automotive Engineering Technician
- Solar Energy Systems Designer
- Drawings Checker
- Detailer
- Technical Illustrator
- Quality Control Technologist
- Sales & Service, Electro-Mechanical Equipment
- Pollution Control Engineer
- Logistics Engineer
- Heating, Ventilation, & Refrigeration Engineering Technician
- Opto-mechanical Engineer
- Field Engineer, Specialist

D. ***Industries Offering Best Job Potential:***

- Computer Manufacture
- Machine Tool Manufacture
- Engineering Services
- Communications and Utilities
- Heating and Ventilating Equipment Manufacture
- Agricultural Machinery Manufacture
- Machine Shops

E. ***Suggested Training for Increased Employability:***

Courses in:
1) Communication skills, written and oral
2) Upgrade in mechanical engineering
3) Environmental health technology
4) Bioengineering/biomedical engineering/technologies
5) Geophysical technology

Recommendations

High quality training programs are required to provide unemployed aerospace workers with the skills necessary to successfully undertake the career transitions outlined in this Chapter. To provide this training it is recommended that:

1. Facilities offering courses recommended for upgrading or retraining should be evaluated to identify those best able to provide the necessary training. Training should be located only at facilities where the best teachers, equipment and course content are available. If necessary, personnel, materials and equipment should be transferred to the facility to ensure that it will offer the best possible training. If possible, the facility chosen should be within reasonable travel distance for the bulk of trainees who will attend the program, but the quality of training should not be compromised by using less than optimal training facilities in order to reduce travel.

2. A review should be made of course content and scope in training programs for occupations considered to be job productive to determine how closely the training meets employers' needs and wants. Training programs should be reexamined, redesigned and restructured as necessary to respond to employer requirements identified through the review.

3. There should be a follow-up evaluation of workers who complete training to determine its effectiveness in enabling them to obtain and retain jobs, and meet the expectations of their employers. This evaluation should determine the extent to which job related competencies have been attained and establish accountability for unattained competencies.

4. Retraining and upgrading programs at all levels should provide tutorial assistance, textbooks and materials, transportation, and financial assistance needed to maintain an acceptable standard of living while attending school.

5. Governance teams of employers, employees, school administrators, teachers, and concerned public representatives should be set up to oversee and assist mixed-age classes, portfolio assessments, educational innovations, and competency-based training programs.

Chapter 8

JOB TRAINING SERVICES FOR AEROSPACE WORKERS

by Daniel Flaming

SUMMARY OF FINDINGS

- **Thirty-eight percent of laid-off aerospace workers need retraining to find new jobs. Many workers are receiving brief exposure to out-placement services but only one to two percent are being retrained. This means that Los Angeles County is losing the productive capabilities of 5,000 skilled workers a year because they are not receiving training to adapt their skills to new occupations.**

- **Seventy-six percent of those workers needing retraining require from 6 to 18 months of training to obtain jobs at skill levels comparable to their old jobs, but virtually no training is being provided that lasts longer than 3 months.**

- **Laid-off workers have had to wait as long as 16 months before training services were available for them. Effective programs begin providing services before workers leave the job.**

- **There is very little capacity in the job training system to provide for basic needs such as maintenance of health insurance so that laid-off workers can remain in training.**

- **There is a lack of accountability for providing a rapid response to aerospace plant closures and lay-offs**

- **In the most recent year the Public Employment Service had contact with approximately 14,000 laid-off aerospace workers but referred only 1% of them to job training programs.**

- **In the most recent year the Public Employment Service received listings of 5,884 jobs in aerospace occupations but filled only 39% of them.**

- **There are very few instances in which job training resources are used to augment community college and adult education resources so that a comprehensive package of retraining services can be provided for laid-off workers.**

- **There is little discernable use of labor market information to guide laid-off aerospace workers into viable new occupations or to coordinate workforce skill development with industrial development strategies.**

OVERVIEW

The Job Training Partnership Act (JTPA) service delivery system is the public sector mechanism for assisting in reemploying displaced workers. Activities of the eight Service Delivery Areas in Los Angeles County that administer these funds, as well as their links with the Public Employment Service, were reviewed to determine their effectiveness in maximizing the existing social investment in skills of aerospace workers, building the skill base of Los Angeles' work force, and helping laid off workers become reemployed. A review of existing programs showed that the job training system is not addressing the scope of training and reemployment needs among laid off aerospace workers nor is it meeting the regional need to maintain a skilled work force. Many workers who have been displaced out of declining occupations and cannot find comparable skilled or productive employment without retraining are being left to their own devices in a harsh economic environment. The following descriptions of exemplary national programs provides a frame of reference for identifying areas in which Los Angeles County's programs should be strengthened.

CHARACTERISTICS OF EXEMPLARY PROGRAMS

Based on a national review of displaced worker programs conducted by the General Accounting Office there are common threads of success in exemplary programs for displaced workers.[1] These common threads include:

1. Early intervention to begin providing assistance before workers leave their jobs.

2. A comprehensive worker assistance center focused on specific closings or layoffs.

3. Extensive knowledge of local labor markets.

4. Individualized counseling and assessment with assistance tailored to specific workers.

5. Competent, rigorous interventions with a breadth and range of services that meets both the occupational and social needs of displaced workers.

6. Personal support and persistent follow-up to assure program completion.

7. State flexibility to select the most competent sponsors.

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[1]United States General Accounting Office, "Dislocated Workers: Exemplary Local Projects Under the Job Training Partnership Act," April 1987.

In exemplary programs the work begins with helping displaced workers and managers relocate into new jobs before the gates close.[2] Workers receive advance notice, participate in forming an in-plant joint labor-management outplacement committee, and receive job search assistance before the lay-off occurs. Project staff develop expert knowledge of local labor markets, including the identification of job openings and their skill requirements. Staff also develop an extensive network of local employer contacts and acquire an excellent reputation with them by providing appropriately skilled workers. Working one-on-one with participants, staff identify participant interests and skills and help them develop a specific strategy that will enable them to compete effectively in the job market. Staff then help participants implement these individually tailored strategies. The projects' activities (such as assessment, job search training, occupational skill training, on-the-job-training, placement assistance, and supportive services) are rigorous and competent. The intensity and breadth of services matches the scope and duration of worker needs. Persistent tracking of participants is undertaken to help ensure their successful completion of training. Project staff work with participants to identify any personal or financial problems that might jeopardize the successful completion of their individual reemployment strategy. When needed, project staff help participants identify and acquire financial aid, personal counseling, and other support services.[3]

The Department of Labor's report on worker adjustment programs points out that in recent years, as plant closings and work force reductions have become more widespread and have occurred in the nation's largest and most strategic industries, there has been an effort to reduce the impact of large-scale lay-offs on workers.[4] This trend reflects both national concern for the plight of these workers and awareness that plant closings and major lay-offs are part of a fundamental restructuring of the nation's economy. This restructuring has changed the way labor, management, and government view and respond to plant closings and work force reductions. These economic dislocations are now viewed as a warning that the nation must prepare today's workers for the jobs of the future.

The most successful programs for laid-off workers are provided through comprehensive worker assistance centers, which serve as a central point for job training, referral, and counseling, along with other services. These centers are usually established through a tripartite effort of companies, unions, and public agencies. Centers are often staffed by

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[2]U.S. Department of Labor Bureau of Labor-Management Relations and Cooperative Programs, "Plant Closing Checklist: A Guide to Best Practice," 1990.

[3]U.S. Department of Labor Bureau of Labor-Management Relations and Cooperative Programs, "Cooperative Labor-Management Worker Adjustment Programs," 1989.

[4]Ibid.

laid-off workers who are known to, and trusted by, other workers, and provide the following services:

- Center orientation and employee benefits counseling.
- Self-help reemployment assistance.
- Services to offset the impact of job loss.
- Direct job placement assistance.
- Education and retraining.

There is a broadly shared public interest in maintaining a highly skilled and productive advanced technology work force in Los Angeles County. If Los Angeles workers cannot match and exceed the skills and productivity of their counterparts in other regions and countries, not only they but the entire regional economy will suffer from lower employment and wage levels, and a lower standard of living. To fulfill this interest, training programs are challenged to reexamine past strategies and adopt standards of excellence for providing workers with the skills to succeed and remain employed in an era of global economic competition.[5] The following sections examine services for unemployed aerospace workers in Los Angeles County in order to identify how lessons from other regions should be applied to the labor market restructuring now underway.

EMPLOYMENT SERVICES FOR AEROSPACE WORKERS

Geographic Factors

Federally funded job training programs for laid-off aerospace workers have been administered through eight Service Delivery Areas in Los Angeles County. The advantage of this diversity is that it allows cities to create programs that are responsive to local needs. A review of retraining programs throughout the County found that the smaller job training jurisdictions tend to operate programs which offer the greatest degree of flexibility and individual responsiveness in helping individual displaced workers. The disadvantage is that labor force dislocations caused by defense cutbacks are a massive, turbulent, regional problem which call for a labor market-wide strategy and a capacity to move resources where they are most needed. The current structure does not meet this need. Resources tend to be allocated based on needs indicated by past rather than current lay offs, some lay-

[5]National Commission for Employment Policy, "Workforce Futures: Strategic Planning in the States," February 1990.

offs fall between the cracks and others receive less inter-jurisdictional cooperation than is needed, and none of the programs are guided by a labor market strategy for linking workers with the best reemployment opportunities.

Program Design

The largest and oldest job training program (JTPA Title II-A and its predecessor programs) is designed to provide short term training and entry level employment for low income individuals who are not enculturated to the work place. The program's design and operational style tend to provide the template for displaced worker programs. The resulting shortcomings that spill over onto aerospace retraining programs include rigid, cookie-cutter programs that do not take advantage of the occupational diversity or problem solving abilities of aerospace workers and short term training that does not maintain the skill level of aerospace workers.

Service Delivery Areas are currently making contact with large numbers of aerospace workers through pre-lay-off meetings at plant sites, outplacement programs and information and referral activities. These services ease the transition for job-ready workers, but they are not a credible response to workers who need retraining.

Accountability

Federal legislation for displaced worker services is structured around the expectation that states will be the lead agencies in responding to plant closures and mass lay-offs. In California this responsibility has been delegated to the Service Delivery Areas. As a consequence there frequently are not trained, funded and prepared staff available to deal with lay-offs. Each lay-off requires a Service Delivery Area to work with a different corporate organization, a community or industry that may be unfamiliar, and an unknown set of employee needs and dynamics. Service Delivery Areas are too often caught off balance and unprepared to deal with lay-offs, and in those cases their assistance for the workers is slow, partial, or even nonexistent.

In the absence of a prepared and organized public sector response to the needs of workers facing lay-off, the firm laying-off the workers remains the lead organization in managing the problem. Even in the case of large corporations with a long term interest in their public image and labor relations, this can be a problem as human relations staff experience their own lay-offs and there is rapid turnover in staff assigned this responsibility. In the case of smaller companies, that are unfamiliar with employment and training programs and may not even want their employees to know a lay-off is planned, this can result in failure to give job training organizations basic information about the occupations, salaries, and cities of residence of their workers.

Inter-Agency Coordination

The Employment Development Department (EDD) is the labor market clearinghouse for the region and also the oversight agency for displaced worker programs. Its activities include referring job-ready workers to job openings and referring other job seekers to training programs. Table 1 shows that only 174 displaced workers in Los Angeles County were referred to training programs in 1991. Aerospace alone sent 13,628 displaced workers to EDD, and approximately 5,000 of them needed training. There is clearly an opportunity

Table 1

TRAINING REFERRALS FOR DISPLACED WORKERS

Los Angeles County July 1, 1990 to June 30, 1991

Service Delivery Area	Number of Displaced Workers Identified by EDD	Number Placed in Jobs by EDD	Number Referred to Training by EDD	Number Enrolled in Training
Carson, Lomita, Torrance	10	0	1	1
Foothill	8	1	0	0
Long Beach	60	6	70[6]	23
Los Angeles City	583	16	21	18
Los Angeles County	562	65	37	19
South Bay	25	1	0	0
Southeast Los Angeles County	47	3	14	8
Verdugo	787	27	31	29
TOTAL	2082	119	174	98

Source: Employment Development Department Report D18, 7/22/91.

[6]Some individuals who had not registered with the Employment Development Department were referred to training, so the number of referrals to training exceeds the number of documented displaced workers.

to improve the level of coordination between EDD and Service Delivery Areas. Table 2 shows that in 1991 EDD received notices from employers of 5,884 job openings for aerospace jobs, but filled only 39% of these jobs through its referrals. Better coordination between EDD and Service Delivery Areas would make it possible for workers in training programs to apply for these jobs. Increased inter-agency coordination is also needed between job training programs and community colleges to take advantage of low cost, long term training offered by the community college system. Most Service Delivery Areas do not have programs that augment community college resources to offer a comprehensive package of retraining services.

TABLE 2

JOB PLACEMENTS FOR AEROSPACE WORKERS
Los Angeles County 1991

Title	Openings '91	Filled '91	% Filled
Accounting Clerk	599	183	31%
Arcft.Mechanic	28	14	50%
Assembler, Prec	7	0	0%
Assembler, Mach	65	30	46%
Assembler, Sml. Pt.	150	69	46%
Assembler, Prod.	315	151	48%
Assembler, Elec.	258	106	41%
Assembler, Arcft.	1304	806	62%
Asmblr, Metal Fab.	10	6	60%
Asmb, Arcft Elec.	18	11	61%
Computer Operator	106	37	35%
Computer Programmer	38	1	3%
Drafter Aeronautical	1	0	0%
Drafter Electrical	7	2	29%
Drafter Electronic	21	2	10%
Drafter Engineering	5	0	0%
Drafter Mechanical	36	10	28%
Electron. Repairer	58	12	21%
Electron. Mechan	80	16	20%
Engineer Aeronautical	3	0	0%
Engineer Aero.Design	2	1	50%
Engineer Electrical	32	3	9%
Engineer Electronic	419	3	1%
Engineer Mechanical	51	9	18%
Engineer Industrial	7	0	0%
General Secretary	794	209	26%
Gen.Office Clerk	425	119	28%
Machinist	183	75	41%
Manager Ind.Prod	11	1	9%
Manager R & D	4	0	0%
Num.Control Oper	59	14	24%
Oper.Rsch.Anlyst	1	0	0%
Prec. Inspector	3	1	33%
Plng.Exped.Clerk	24	5	21%
Production Insp.	7	3	43%
Purchasing Agent	58	9	16%
Sheet Met. Worker	54	30	56%
Stock Clerk	533	338	63%
Systems Analyst	13	0	0%
Technician Eltri	6	1	17%
Technician Eltro	69	19	28%
Technician Mechanical	10	1	10%
Technical Writer	10	0	0%
TOTAL	5884	2297	39%

Source: 1991 EDD B96 Metropolitan Statistical Area report.

Timeliness of Funding

Even though there are resources allocated at the federal, state and local levels to serve displaced workers, it is the exception rather than the rule to provide a timely response to the needs of workers. At the Service Delivery Area level, funds received annually through formula allocation are generally contracted out at the beginning of the program year to operating agencies. These agencies may be unable or unwilling to respond to a particular lay-off, or may have exhausted their funding by the time a lay-off occurs. The State holds funds in reserve for mid-year lay-offs, but it typically takes at least six months to allocate these funds and authorize their expenditure. Federal funds must be obtained through a State allocation,

and in at least one instance it took over sixteen months to obtain these funds.[7] When the funds arrived they could not be used for any workers who had received any services prior to that time. The failure to respond to lay-offs with timely funding means that programs typically do not begin until after Unemployment Insurance benefits have been, or are close to being, exhausted. The only viable training option becomes on-the-job training because it will provide income for the worker. This is in stark contrast to exemplary programs, which assess and enroll workers for retraining programs before they are laid-off.

Use of Training Funds

In an effort to increase the proportion of job training funds that are used for actual skill development activities the Department of Labor requires that a majority of funds be used for core training activities. While this rule may raise performance standards in other JTPA programs, it has the effect of undercutting long term training for displaced workers. This is because long term retraining requires inter-institutional collaboration to meet both income maintenance and skill training needs. The Department of Labor's requirement eliminates the flexibility needed to use job training funds for income maintenance needs while workers participate in community college or university retraining programs. Income maintenance needs include such things as payment of family health insurance premiums, transportation allowance, child care, or food costs.

If they could receive assistance in paying for basic living expenses, many workers would be able to make personal financial sacrifices and complete long term vocational or professional retraining programs offered by community colleges and universities. But this currently is not possible because a fixed amount of job training funds are already committed to covering administrative costs and the preponderance of remaining funds must be used for skill training. Consequently, these funds are used to directly finance short term skill training lasting 8 to 12 weeks rather than to leverage long term retraining in collaboration with other training institutions. One of the findings in Chapter 7 was that 76% of the aerospace workers who need retraining should be in programs that last from 6 to 18 months. Federal limitations prevent job training funds from being used to greatest advantage in meeting this need.

Number of Workers Being Trained

Based on findings in Chapter 6, at least 13,628 laid-off aerospace workers sought public sector assistance to find a job in 1991. Using the finding from Chapter 7 that 38% of these workers need retraining to find a job with skill and pay levels even approaching their old

[7] Delays in obtaining these funds are noted by Congress of the United States Office of Technology Assessment, After the Cold War: Living With Lower Defense Spending, February 1992, p. 80.

jobs, this means that 5,178 of these workers should have received training. The best information available indicates that at least nine-out-of-ten of these workers who need retraining did not receive it. The Federal Reserve application submitted by the State in 1991 set a goal of providing skills training for 4% of workers from a limited number of lay-offs. Some Service Delivery Areas are not able to identify their share of workers who need retraining. One jurisdiction that could make this determination provided data indicating that 1% of the aerospace workers laid-off in their area had been enrolled in skill training programs.

Effective displaced worker programs are able to enroll approximately 15% of laid-off workers in retraining programs. Using this benchmark, and taking into consideration the increasing rate of lay-offs in Los Angeles County, aerospace retraining programs should be serving 3,000 workers a year. This would require at least a five-fold increase in the level retraining funds being provided for laid-off aerospace workers in Los Angeles County.

Retraining Standards for Aerospace Workers

Retraining standards that will contribute to preserving the productivity and skills of aerospace workers and should be incorporated retraining programs include:

1. Making optimal rather than minimal matches between the skills and aptitudes of displaced workers and the requirements of new jobs. This should include making greater use of aptitude tests, skills transference inventories, and labor market data.

2. Encouraging a high degree of flexibility in the design of training and supportive service programs for laid-off defense workers so as to encourage the emergence of program models specifically tailored to the needs of skilled workers rather than the needs of socially dependent individuals.

3. Obtaining a waiver of the JTPA requirement that 51% of funds must be spent on core training. The purpose of this would be to allow displaced worker funds to be used in conjunction with community college programs to provide long term supportive services to meet such needs as transportation, child care, health insurance, and needs-based payments while workers participate in training programs to learn new occupations. This support should be available for whatever length of time is required to obtain an A.A. degree, or the equivalent, while enrolled as a full time student.

4. Supporting the initiative of displaced workers in finding innovative means of becoming reemployed, including vouchers for self-selected training programs and entrepreneurial projects for becoming self-employed.

5. Supporting long-term retraining of workers from all skill levels who face barriers to reemployment so that they can reenter the work force in a skilled capacity. Job training jurisdictions and local education agencies will need to strengthen their capacity for cooperation to help workers remain in training long enough to achieve these skill gains.

6. Making available long-term supportive services for workers who experience personal or economic dislocations and face barriers in making a transition to a new career.

7. Opening comprehensive job training and supportive service centers in the lower income communities of each defense dependent zone. The vulnerability of these communities to economic dislocations makes it a high priority to provide intensive job training and placement services for lower income defense workers who lose their jobs.

8. Establishing a human resources policy for Los Angeles County which defines expectations for retraining programs and incorporates lessons learned from other regions of the nation as well as findings specific to the advanced technology work force being displace out of aerospace.

RECOMMENDATIONS

1. The Job Training Partnership Act (JTPA) system is not meeting the needs of laid-off aerospace workers in terms of the quantity, quality or timeliness of services, nor in terms of essential coordination among related services. It is recommended that the Board of Supervisors request the Governor to implement reforms in the current system or utilize a more effective alternative mechanism to serve laid-off aerospace workers. Recommend reforms include:

    - Expediting the State's pass-through of federal funds to the local level.
    - Enabling job training funds to be used flexibly to augment the training services provided by community colleges and adult education programs.
    - Mandating coordination of Public Employment Service, JTPA, community college, and adult education programs to meet the needs of aerospace workers.

2. The current level of resources for retraining aerospace workers is not adequate. Once needed reforms have been made in the service delivery system there should be a five-fold increase in the level of federal job training funds provided for laid-off aerospace workers.

Chapter 9

TRANSFORMING A DEFENSE DEPENDENT INDUSTRIAL BASE

STRATEGY OVERVIEW

by Daniel Flaming and Allen J. Scott

INTRODUCTION

The current and future prospects of the Los Angeles economy are extremely troubling, as indicated in earlier chapters of this report. Federal funding for defense is falling sharply, and the local share of this funding is dropping even more rapidly. Defense manufacturing is heavily focused in a handful of large firms that have limited capacity to convert their resources to civilian applications. Furthermore, there is a growing tendency on the part of many of these firms to move significant sections of their blue-collar production activities out of the region. As the economic tides now sweeping over Los Angeles become increasingly uncertain, it is imperative that the region develop a feasible policy agenda to deal with mounting economic problems. In the absence of such an agenda, there is a real possibility that Southern California (or significant portions of it) could experience many of the same symptoms of deindustrialization and job loss that characterized the Northeast of the United States over the 1970s and 1980s.

Aerospace, Los Angeles County's most important manufacturing industry, has been declining since 1987, and this process of decline accelerated during the 1990s. An industrial development program could help salvage the social investment and economic productivity linked to skills of aerospace workers; at the same time, it could help spark off a new, dynamic growth trajectory for the region's economy. Los Angeles is at the cutting edge in developing new technologies in energy sources, electronics, space exploration, advanced materials, instruments, and other emerging areas of commercial activity. It is also creating new markets for emission control and transportation technologies as it establishes novel precedents for improving air quality. These opportunities need to be more forcefully connected with the productive capabilities of the region's industrial base and work force.

DYNAMICS OF INDUSTRIAL GROWTH CENTERS

One of the great dangers in this economic crisis is to respond with short-run and opportunistic (and ultimately self-defeating) remedial action. The other is to do nothing and presume that self-correcting dynamics of pure market forces will eventually bring the region back onto a course of economic growth and prosperity. The recent decline of manufacturing in the US Rustbelt has shown that once activated, the processes of deindustrialization often become chronic. Moreover, some of the most successful economies of the late Twentieth Century (e.g. Germany or Japan) are those that have learned how to supplement market forces with potentiating institutional structures. These institutions have

helped promote high levels of worker skill, rising productivity, and superior product quality. Los Angeles can no longer afford to neglect the example of its competitors who have relentlessly and effectively used public policy to push industrial development and compete in international markets. The world's strongest industrial growth centers obtain competitive advantage from the stabilizing influence of cooperative arrangements and region-wide manufacturing structures. These collaborative efforts help to create a stable playing field, predictable long-range goals, and enhanced flows of information. Government plays a partnership role in creating superior developmental conditions for adaptable technologies and flexible organizations. One of the common characteristics of these mechanisms of economic coordination is that they foster a shared strategy for supporting industrial growth. Beyond this, they vary in design and function, because each takes advantage of unique institutions and strengths of its particular economy and culture.

Dynamic industrial regions are typically organized as strongly-interacting network systems and local labor markets. So long as the central motors of growth are operating, this characteristic binds producers powerfully to particular places, creating localized poles of intense economic activity. The result is a transactions-intensive industrial agglomeration marked by many-tiered ripple effects as firms buy from and sell to one another. Even at the best of times, however, these complexes, when left to their own devices, are susceptible to severe internal market failures on a variety of fronts (e.g. in areas of new technology development, worker training, information flows, premature lock-in of inferior developmental trajectories, and so on). And when the central motors of growth themselves begin to unwind (in the case of contemporary Los Angeles because of both declining DoD expenditures and a heightening of foreign competition) then the multiple interdependencies of the whole system give rise to massive dislocations.

As Michael Porter has argued in a recent influential book[1], nations and regions gain competitive advantage when they have dynamic specialized industrial agglomerations (with their intense systems of external economies). However, their dynamism is typically an asset that is held jointly by all participants in the economy. It depends, of course, on individual efforts, talents, and skills; but it also depends in a major way on the synergies that exist within the system as a whole. These synergies are a legitimate and indeed pressing object of public policy. Such policy when badly designed can be worse than useless; when it is well-designed it can greatly enhance the synergistic effects of the whole system and contribute significantly to local growth. In general, public policy in this area needs to deal with three very broad issues which are particularly susceptible to market failure, and where, in the absence of effective intervention, costly instabilities and unpredictabilities can occur:

- *Scale.* Many firms are too small to sustain critical services such as labor training, research and development, international marketing, and so on. However, when they are organized in association with other firms, efficient provision of such services can be secured.

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[1]Michael E. Porter, The Competitive Advantage of Nations, New York: The Free Press, 1990.

- *Scope.* Firms embedded in dense network systems face many problems of information flow. It is costly to obtain accurate information. It is difficult to scan all potential sources of information, and the fiduciary standards of any information received may be doubtful. These problems are especially acute in industrial agglomerations where much commercial and technological development depends critically on effective inter-firm transacting. This is an area, again, in which it is possible to construct very efficient private-public partnerships in the interests of competitive advantage on wider markets.
- *Strategy.* Modern development theory suggests that at certain stages in a region's development it may face a wide variety of possible growth trajectories. Over time, a particular trajectory tends to become "locked-in" in the sense that it becomes extremely expensive and difficult to move onto another developmental path. For example, an argument might be made that some segments of the Los Angeles economy (in particular, the burgeoning sweatshop component) have since the early 1960s become locked into such a trajectory; declining wages, skills, and productivity, now represent a self-engendering downward spiral. A well-designed policy could - in principle - reverse this trend. As the Japanese and European experiences have shown (and indeed as the DoD itself has amply demonstrated in the past) it is possible to put into place structures of governance which support long-term strategic interests and curb damaging "spontaneous" tendencies.

Institutions for supporting industrial growth are most effective and viable when built upon existing social standards. Their purpose is to help each region realize the productive potential of its own unique specialized work force, entrepreneurial talents, and networks of inter-industrial relationships. They achieve this purpose by filling collective needs which cannot be efficiently supplied through normal market channels.

BUILDING ON STRENGTHS

There are great difficulties in any attempt to achieve basic local economic transformations. The most realistic strategy is to build incrementally on the existing industrial base and labor force. Each region must determine what precise mixture of market relations, corporate self-management, and public-private partnerships provides the most desirable framework for development.

Well-designed institutional structures for containing market failures and increasing coordination will both capture latent positive benefits and diminish negative impacts caused by the external economy. Specific areas and problems that call for particular attention by means of a coordinated approach involve the following:

- The production of appropriate forms of technological research and its transformation into commercializable products.
- Programs for the provision of expert assistance in making incremental improvements in manufacturing processes and products.

- Collective agreements about intellectual property rights as a basis for collaborative research and development programs.
- Development and upgrading of labor skills and the more creative involvement of workers in production processes.
- The development of an infrastructure of support services for small manufacturers, including the provision of marketing and exporting services.
- The elaboration of inter-firm networks for cooperation and information exchange.
- Local government programs which offer support to manufacturing activities through the active initiation of suitable development projects (e.g. the creation of new science parks), and more effective land use management and servicing.
- Increasing the predictability of the business environment by providing reliable assurances about future regulatory requirements, availability of financing, and guaranteed procurement commitments for new products.
- The active use of local procurement strategies to support the growth of industry.
- The provision of high-risk capital for promising start-up businesses and loans for small businesses.
- Strategic monitoring of new industrial opportunities for the region and an early warning system for industries that are beginning to fail in the competitive race.

As a matter of principle, efforts to develop industrial growth centers should always try to build upon special local endowments, the most important of these being existing stocks of manufacturing capacity and expertise. It is also probably unwise to attempt to reproduce forms of industrial activity that are already highly-developed in other regions. The many examples of localities that tried - and failed - to become the next Silicon Valley add force to this proposition. More generally, the first mover advantages and acquired external economies of existing agglomerations make it difficult to clone them at other locations.

The special endowments of Los Angeles that could be mobilized in any concerted local economic development strategy aimed at diversifying the high-technology industrial base include the following:

- A rich stock of aerospace industries with technological and manufacturing capabilities applicable to a wide variety of newly-growing industries, such as electric cars, medical instruments, pollution control devices, robotics, and so on.
- Dense networks of subcontractors and specialized input providers in electronics, machinery, metal-working, plastics, advanced materials, and other sectors. These networks are likely to be one of the primary bases of any major new growth industry, since their very structure is highly flexible and adaptable.
- A large pool of engineering, technical, and skilled craft labor.
- A large number of public and quasi-public agencies (AQMD, LACTC, the utilities, local governments, and other regulatory bodies) who are now searching actively for a means of responding more positively to the needs of industry. Already, this search has produced significant momentum around the infant electric car industry in the region.

- A highly-developed urban region equipped with abundant infrastructural services.

OBSTACLES TO PUBLIC SECTOR SUPPORT OF HIGH-TECHNOLOGY INDUSTRIES

Despite its technological and industrial capabilities, Los Angeles must also overcome formidable institutional barriers to the achievement of goals of economic diversification, regeneration, and renewed growth based on public policy. These barriers include:

- The marked underdevelopment (especially when compared to other parts of the USA such as Pennsylvania or Massachusetts) of broadly-based coalitions for supporting local industrial growth.
- As a corollary, the lack of effective centers of power which see it as their responsibility to ensure that new industries develop in Los Angeles.
- The difficulties of establishing a consensus about a common civic agenda.
- Failures of leadership in the business sector. The business sector does not speak or act in a unified manner, even on matters of fundamental self-interest. Moreover, whereas Los Angeles has some 400,000 business establishments, there are relatively few large firms headquartered in the region and many of them do not have fundamental long-run commitments to Los Angeles.
- Divergent and fragmented political leadership. Los Angeles is governed by the County, special regulatory districts, special-purpose districts, and nearly a hundred city governments, and it receives state and federal representation through 24 Assembly districts, 13 State Senate districts, and 17 Congressional districts. This represents a potentially powerful political force but it is difficult to achieve unity, especially when there are few historical precedents and when the way forward is fraught with innumerable problems and unknowns.
- The severe lack of a knowledge base in local government agencies about basic technological and manufacturing issues. This lack hampers effective decision-making.
- Limited institutional experience in forming partnerships between representatives of industry, local government, academia, and other relevant parties for the purposes of local economic development.
- The decision of many prime contractors to respond to recent defense reductions by cutting their labor force and adopting an economically-defensive posture rather than to seek actively to adapt their technologies and manufacturing facilities to new commercial markets. Fortunately, there are some outstanding exceptions to this observation.
- The past habituation of defense industry managements to high levels of overhead and cost-plus pricing strategies. These habits are a severe impediment to competitive success on commercial markets.
- The concentration of the defense industry in a handful of large prime contractors (ten of these account for 80% of all local defense revenues). This concentration increases the vulnerability of the region to any weaknesses among major producers.

Successful modern flexible production agglomerations, by contrast, tend to be characterized by a much more diffuse pattern of manufacturing activity.

Historically, the Los Angeles region has had an overtly *laissez-faire* approach to industrial development (though the involvement of the DoD did in fact constitute an overarching *de facto* industrial policy that provided stability and continuity of purpose). Certainly, the region has not yet developed institutions capable of implementing an industrial development strategy that addresses directly its current problems and predicaments. Social and cultural resources previously unconnected with industrial development will now have to be harnessed to provide a stabilizing framework for supporting growth of the high-technology industrial sector.

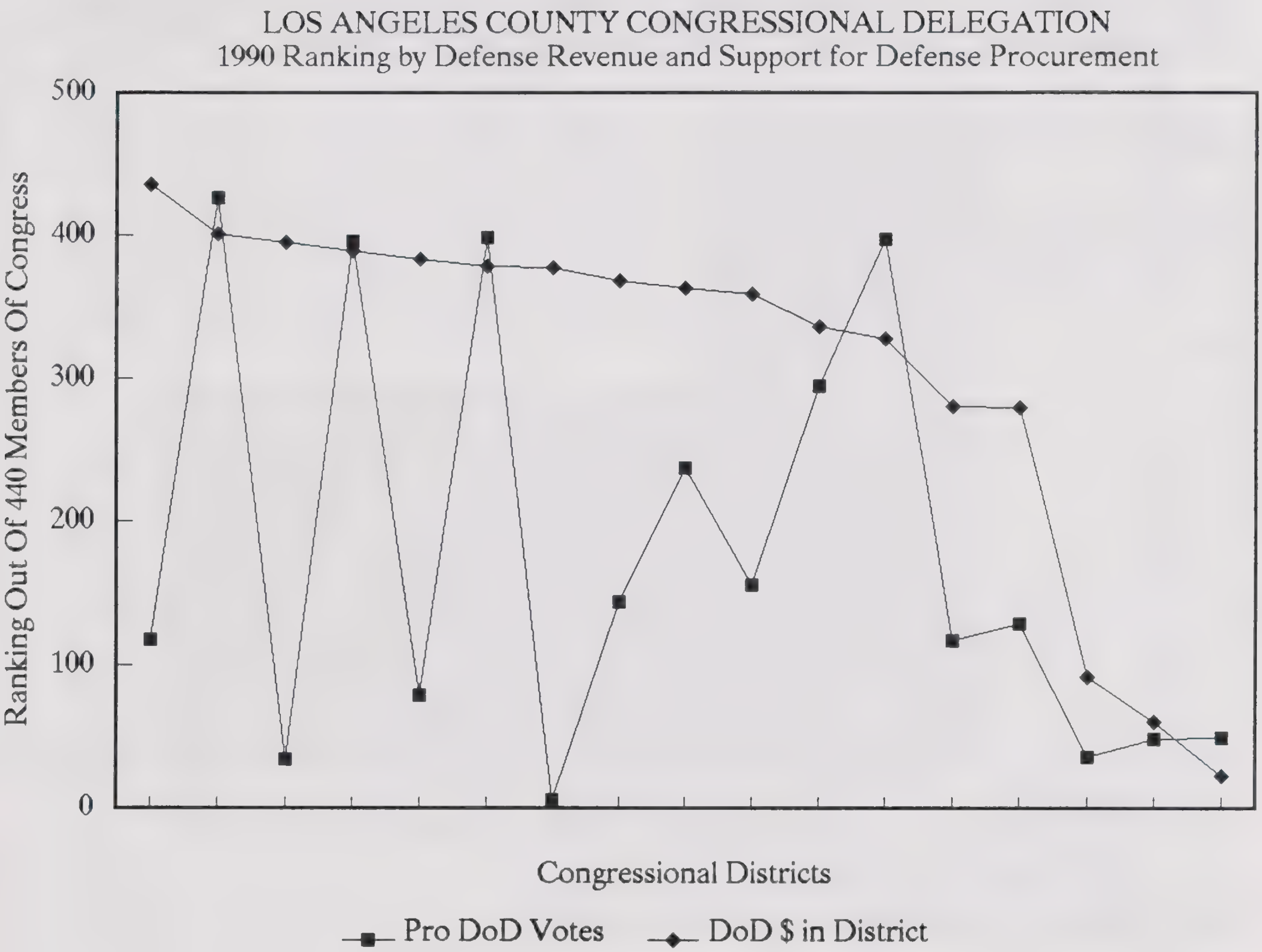
FORGING AN INDUSTRIAL DEVELOPMENT STRATEGY

The defense industry in Los Angeles has an abundance of workers with advanced skills that could be applied to a broad range of new industrial endeavors. However, there is much inertia in the local industrial system that impedes the full realization of these possibilities. At the same time, local governments have hitherto been extremely reluctant to direct or plan any form of regional industrial development. A middle ground needs to be found between the rigidities that have up to now characterized the defense industry, and the attitude of noninterference on the part of the public sector. Moreover, public officials in the Los Angeles region have in the past been ambivalent about the defense industry, offering uneven support at the national level for defense procurement funding, and paying very little attention to the industry at the local level. The stance of Los Angeles has been to accommodate, and benefit from, defense-related manufacturing. But this stance has not been clearly defined or consistently supported. The current defense-industrial complex in Los Angeles is an artifact of social circumstances which include:

- Polarized public views about the desirability of defense spending.
- Absence of creative linkages with local government.
- Labor-management relations that have frequently been adversarial.

The lack of consensus in Los Angeles in support of the defense industry can be seen in Figure 1. The top line in the graph shows the high levels of revenue from defense procurement coming into most of the congressional districts in the County, when ranked against all members of the House of Representatives in 1990. The second, jagged line shows the uneven support of the County's congressional delegation for defense appropriations, when ranked against the votes of all members of Congress. The bar graph in Figure 2 shows that on average the County's congressional districts were in roughly the top quartile in terms of defense revenue, but roughly at the midpoint in Congress in terms of voting for defense appropriations. This level of support for defense appropriations is identical to that provided by Iowa's congressional delegation. The reason, of course, for County congressmen's uneven support for defense procurement was the belief of some that a disproportionate share of national resources was going to military needs. This is a

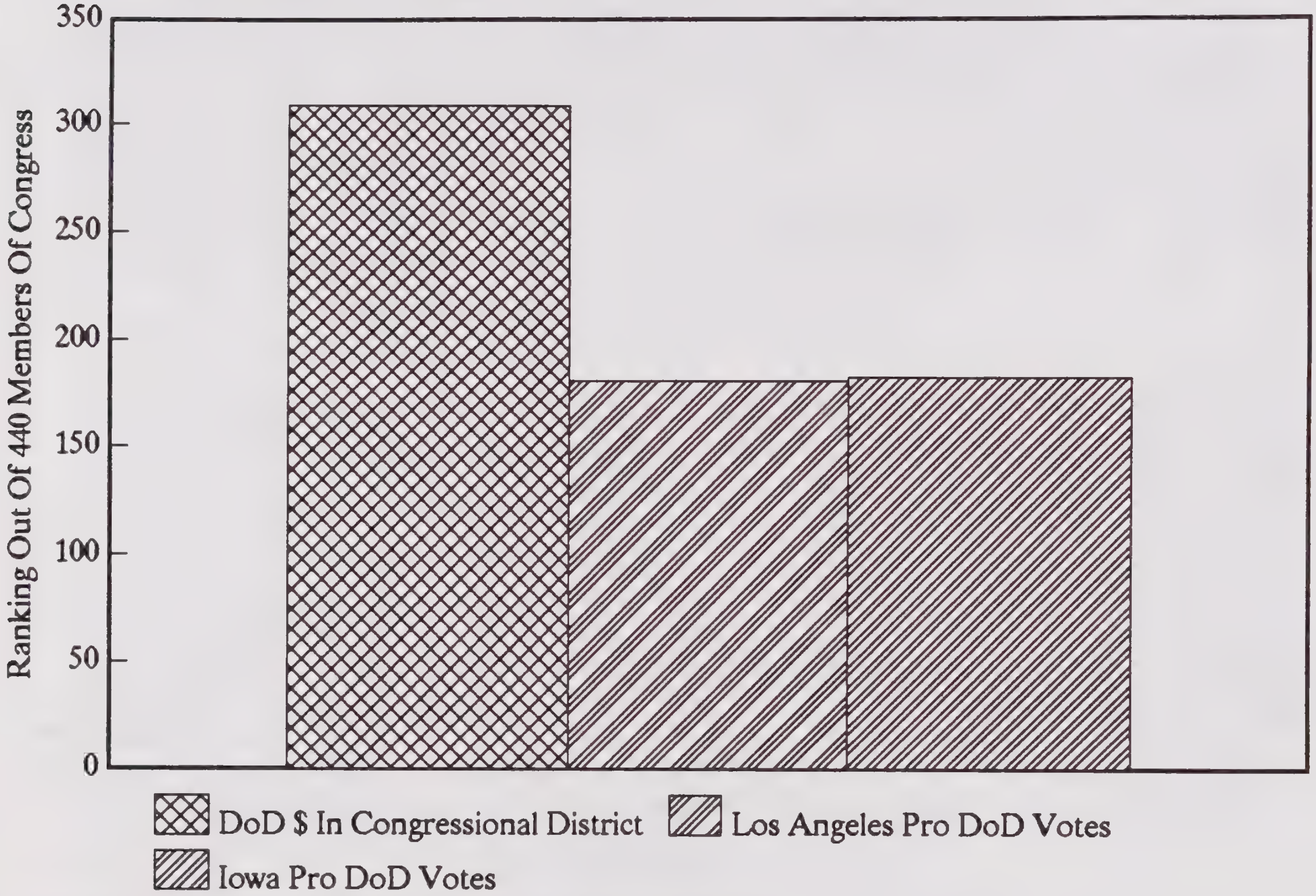
Figure 1



legitimate perspective on public priorities, but from the perspective of industrial development, it is clear that this level of backing does not provide adequate support for an advanced-technology industry that other regions are trying to attract. If Los Angeles is to promote successfully the development of high-technology industries without the benefit of massive defense revenues, it will have to provide more support than it has provided for aerospace. The first crucial lesson from this polarization over support for the defense industry is that the region must identify goals for its high technology industrial complex that are broadly supported rather than divisive. The second is that local government must become constructively involved in supporting the competitiveness of this sector. The need to define widely-supported industrial development goals represents an opportunity to discover and rationalize the priorities of the region. Paradoxically, the fading away of the Cold War will probably facilitate a more consensual politics around these issues than was the case in the past.

Figure 2

1990 DEFENSE REVENUE AND SUPPORT FOR DEFENSE PROCUREMENT



Source: National Journal, "Congress and Defense 1990."

COLLABORATIVE PROBLEM-SOLVING

Creating regional consensus around an industrial development strategy is a make-or-break task for preserving the competitiveness of Los Angeles' high technology complex. This is a prerequisite for establishing long-range goals that can provide a stable frame of reference for public sector coordinating activities. This inter-institutional collaboration will require participants to adapt to an enriched, more complex political/administrative process which links a broad vision of the public interest with the maze of practical detail that characterizes public programs. Four ingredients are required to formulate and act upon this collaborative agenda. They involve (1) development of consensus, (2) overall coordination of decision-making, (3) an ability to build incrementally in stages, and (4) centralized monitoring of trends.

First, a unifying and sustainable vision of the public interest must be offered. It has been common for public interests in Los Angeles to be framed in ways that are adversarial rather than unifying. A familiar example is the assertion that there is an either/or choice between economic growth and competitiveness on the one hand, and public goals for the achievement of environmental quality and social equity on the other hand. These polarized priorities can in part be reconciled through a unifying industrial development strategy. Environmental compliance could become a springboard for retooling with clean technologies that conserve materials and reduce waste, and investments in worker skills and employment services could be recognized as yielding high dividends through reduced social dependence and increased productivity. This restatement of issues to integrate the goals of different sectors of the public interest is more intellectually complex but it offers a realistic view that works ultimately to the advantage of all parties.

Second, an incisively framed set of ideas must be offered, and it must have enough social importance to mobilize different groups and interests. Many public sector programs have ambiguous or mismatched statements of goals that betoken a lack of clear direction about how costs and benefits should be distributed. A clear sign of this problem is the plethora of narrowly focused and fragmented responses to economic development issues. The Los Angeles County Transportation Commission is debating whether or not it should be concerned with the industrial development potential of its expenditures. The South Coast Air Quality Management District is beginning to examine how it should offset the socio-economic impacts of its regulatory strategies. And school districts and job training jurisdictions are offering programs which very imperfectly match local labor market conditions and needs. The County remains a major stake-holder in each of these areas of public policy, but has not yet offered leadership that would provide a unifying purpose, even though erosion of the manufacturing base is imposing on the County both dramatic increases in costs for social dependency and reduced revenues for defraying those costs. The goal of retaining a strong industrial base and a productively employed work force has enough social importance to mobilize each of these sectors; what remains is to frame this goal in a manner that embraces the core objectives of these public sector organizations.

Third, the formulation of a workable industrial development strategy must unfold in a way that allows the participants to move a single step at a time beyond the known. Each step should build on, and move a little beyond what each participating institution already knows and is familiar with. Each step should offer enough challenges to hold the attention of the main parties, but it should not be completely unfamiliar and, therefore, too uncertain. At this point there is general public awareness that the issues of mass transportation, environmental quality, alternative energy vehicles, and job creation for high-technology workers are all interrelated. A feasible next step would be to frame an inclusive statement of public goals for achieving clean air and adequate transportation for a skilled, economically self sufficient work force in a growing high-technology industrial complex. These goals should be stated in sufficient detail to guide decision-making for all relevant areas of public policy.

Fourth and last, a policy brokering and research service must be available in the form of a bridging organization that understands the policy environments of participating public agencies and can assist them in translating policy objectives into their own frames of reference. This brokering service should initiate inter-institutional dialogue and collaboration around areas of overlapping responsibility or concern. It should also be a source of relevant, reliable strategic data about the County's industries and workers, and should assist public agencies in systematically applying shared policy objectives and strategic data to decisions affecting industrial development. Such data are essential because policy-driven decisions (as opposed to systems-maintenance decisions) about industrial development require constant assessment of the economic environment and of the impacts of policy decisions on that environment. This is particularly the case because the limited resources of local government are only one of many forces affecting industrial competitiveness, and these resources are fragmented among multiple institutions in the County.

KEY INSTITUTIONS IN THE PUBLIC-PRIVATE PARTNERSHIP

The County's institutional structure for high-technology industrial development should be created through a voluntary partnership of industry, government, and research universities. These entities are proposed because they are centrally-relevant institutions with a long-range stake in the regional economy. But there is little precedent for these institutions to assume this role or participate in such a partnership.

Within the government sector, the County is the key entity, because its jurisdiction covers much of the affected industrial base. As a consequence it bears much of the cost of social dependency resulting from unemployment and therefore has a stake in industrial growth. And it is the most powerful unit of local government in the region with the greatest capability to mobilize other sectors of government. For these reasons the County should assume a leadership role in organizing this policy offensive. Other public sector participants should include cities within the County, the Air Quality Management District, the Business-Transportation and Housing Agency and other appropriate State Departments, congressional representatives, and the California Institute.

The three research universities in Los Angeles County, UCLA, USC, Cal Tech, have strong capabilities for managing and researching technology- and manufacturing-related issues. Each of these universities is affiliated with the California Council on Science and Technology, which is formulating technology development and commercialization strategies on a state-wide scale. These organizations should be enlisted to guide public sector decisions related to the development of local industry.

The industry nucleus for this partnership should include large firms with a long-term stake in the Los Angeles economy. This includes utility companies, banks, petroleum companies,

and aerospace companies that are committed to remaining in the County. In addition, the voice of small business should be given a major hearing.

Creation of this coordinating institution will depend on the County enlisting industry and universities and then mobilizing an expanded coalition that includes federal and state political leaders, special jurisdictions such as air quality and transportation agencies, and business firms in the advanced technology sector.

ACTIVITIES OF THE PUBLIC-PRIVATE PARTNERSHIP

Four clusters of activity should take place under the auspices of the government-industry-university partnership: (1) an industry forum, (2) a large-scale research and commercialization program, (3) a small business assistance program, and (4) provision of strategic information.

1. The industry forum should involve regular meetings of government and industry leaders to build a broadly-shared consensus about key industries for the region and to identify industry needs and opportunities for public-private cooperation. A direct off-shoot of this forum should be a policy brokering service to ensure timely resolution of state, regional and local regulatory issues, and support action on integrated public sector goals.

2. The research and commercialization program should be implemented through a newly created Consortium for Clean Energy and Power Sources made up of research universities, participating firms, and local government. The County and representatives of other levels of government should actively seek out federal and state research funds to be channeled through the consortium to support research and development of fuel cells, advanced batteries and other technologies for electric vehicles and clean energy sources, with matching industry matching funds.

3. The small business assistance program should facilitate new business spin-offs from large aerospace firms and provide support to high technology entrepreneurs and small businesses in the form of commercial counseling and assistance and financial support based on careful review.

4. Strategic information services should include: assistance in matching customers and suppliers to form new industry networks; the provision of information on industry and labor market trends; facilitation of the interface between industry, universities and government; and integration of public sector policy objectives.

* * * *

The economy of Southern California is currently at a critical turning point in its history. A variety of possible alternative future pathways of development now seem to be opening up. One of these involves a scenario of extended industrial decline as Department of Defense cutbacks bite more deeply into the region's economy, and as foreign competition in aerospace-defense products becomes ever more intense. In this scenario the region is likely to be faced with increasing, major losses of high-paying skilled and semi-skilled blue-collar jobs while an expanding sweatshop sector takes the region down the path of low wages, low levels of skill, and low productivity. As extreme as this scenario may appear to be, elements of it are already strongly perceptible in the industrial landscape of Southern California. Another possible scenario is one in which the region, building on its acquired endowments and talents, moves towards high levels of industrial innovation, where wages, skills, product quality, and productivity begin to rise upwards, and where the region climbs once more to mastery of international markets in its main industrial products.

Policy can make a crucial difference in how the region's economy evolves over the 1990s, and in determining what elements of these two scenarios will come to characterize its future course of development.

RECOMMENDATIONS

It is recommended that the Board of Supervisors adopt a resolution establishing a policy objective of implementing an industrial development strategy for Los Angeles County, as proposed in this chapter, and that it take the following actions toward achieving this objective:

1. Select an organization to continue building on the information base presented in this report and provide the policy brokering and research service required to develop and implement the County's industrial development strategy.

2. Request participation of the industry, university and government entities recommended in this chapter in developing a public-private partnership based on an integrated statement of public goals for mass transportation, environmental quality, alternative energy vehicles, and job creation for high technology workers.

3. Begin development of action plans to act on strategic industrial development opportunities identified in this report that require inter-institutional collaboration, including the Consortium for Clean Energy and Power Sources, the industrial export policy, integration of air quality compliance programs with industrial retooling and development of high technology industries, and retrofitting a defense manufacturing facility to support a multi-institutional program for producing advanced transportation equipment.

Chapter 10

INFORMATION FOR STRATEGIC ACTION

by Daniel Flaming

NEED FOR INFORMATION

The industrial development strategy being recommended for Los Angeles County requires accurate, comprehensive, current information that enables public and private partners to share a common understanding of the high technology industrial complex and how their actions affect its growth. Rapid decline in aerospace employment is pushing the County to develop new capabilities for promoting industrial growth in order to reduce manufacturing losses and help build new industries. The County is challenged to manage a host of uncertainties about the economy, growth potential of specific industries, methods for supporting industry growth, and the integration of public and private sector goals in order to retain and create productive, lasting jobs for its workforce. Strategic information is the compass for managing these uncertainties and steering the way to a strong, competitive industrial base.

A strategy driven policy for stimulating industrial growth with both short and long term objectives requires much more information than a passive policy of observing change from the sidelines. Much of the leverage for influencing growth of high technology industries is found at the periphery of traditional institutional roles and in new institutional alliances. This means that information is needed to provide a road map for unfamiliar forms of cooperation and new kinds of decisions.

The additional factors of partial control and rapid change make the need for information even more important. The aggregate impact of policy actions by local leaders will be enough to influence, but not control, patterns of growth and decline in an economy that is also shaped by national trends, federal budget decisions and global economic competition. Therefore, accurate information is needed to understand processes of change and identify areas where there are the greatest opportunities for favorably influencing industrial growth. This is particularly the case because industrial growth is a long term goal but decisions for achieving this goal must be made in the context of turbulent short term economic changes as well as long term industrial trends.

Types of Information

Labor Market Information

Labor market information provides a map for making public investments in worker skills, as well as for helping individuals find the best possible jobs. It provides answers to such questions as

- Which industries will provide lasting opportunities for job seekers?

- What are the wages, hiring requirements, and advancement characteristics of major occupations in Los Angeles County?

- In which industries and communities can laid-off aerospace workers find jobs that are commensurate with their skills and wage potential?

- What are the career transition opportunities for laid-off workers from different occupations and what kind of training is required to take advantage of these opportunities?

- What has happened to workers who have been laid-off?

- What changes in the occupational composition of the workforce are occurring as a result of industry changes?

- What skills are required to get into and keep stable jobs that offer opportunities for career advancement?

- What are the wage impacts of growing and declining industries?

Industry Information

- Which industries are growing and declining in employment in Los Angeles County?

- Which of the growing industries will help increase overall employment in the County and provide lasting opportunities for job seekers?

- Which industries have the potential for accelerated growth?

- What are the interrelationships among industries and how will changes in one sector affect other sectors?

- What competitive advantages do industries obtain from being in Los Angeles and which industries benefit most from these advantages?
- What are the obstacles to industry growth in Los Angeles and which industries are most affected by these obstacles?
- What are the concerns, growth expectations and patterns of change in high technology industries?
- What new patterns are emerging in defense procurement and how will they affect Los Angeles County?
- What assistance is needed to match customers and suppliers to form new industry networks?

Policy Information

- How will regulatory decisions affect specific industries, communities, and groups of workers?
- What new markets will be created by public sector regulatory or procurement decisions and what opportunities will this create for industries in Los Angeles?
- What strengths do Los Angeles industries have that could be built on through public sector requirements for transportation or environmental quality infrastructure?
- How can the objectives of institutions and industries in Los Angeles be achieved through cooperative strategies and how can linkages between institutions be made more efficient?

RECOMMENDATION

It is recommended that the Los Angeles County Board of Supervisors select an organization to build on the information base presented in this report and provide the policy brokering and research services needed to implement an industrial development strategy for Los Angeles County. It is also recommended that a grant of Economic Development Administration funds be made to support these activities and that responsibility be delegated to the selected organization for raising funds to match this grant.

Chapter 11

COMMERCIALIZING CLEAN ENERGY AND POWER TECHNOLOGY

A STRATEGY FOR NEW BUSINESS OPPORTUNITIES

by Daniel Flaming

Los Angeles County's population density, high energy usage, and abused and fragile environment have created precedent-setting needs for environmentally compatible energy and power sources such as zero-emissions automobiles and clean industrial facilities. Los Angeles is creating global markets which will grow exponentially as the United States, Japan and Western Europe have increasing demands for energy and power, as well as cleaner environments, during this decade and the coming century. Additional energy and power will be required as economic growth occurs in developing countries. Los Angeles is also the world leader in developing many of the power and energy technologies that will be used to satisfy this growing market. The challenge is to build upon Los Angeles' competitive advantage and ensure that the technological knowledge being generated in local universities, laboratories and high technology firms becomes a catalyst for local economic activity to satisfy markets for clean energy and power sources being created in Los Angeles.

Cutting edge research at Cal Tech, JPL and USC into direct oxidation, near ambient temperature fuel cells has made Los Angeles the world leader in this technology. Related advanced research is also underway in proton exchange membrane technology, novel filtration techniques, sensor development, ionic conducting polymers, polymeric composite current collection, supercritical fluid technology, and advanced anodes, electrolytes, and cathodes. These technologies offer a means of diversifying this region's high technology industrial complex into electric vehicles and related commercial markets for low emissions, high efficiency energy and power technology.

It is likely that Los Angeles will develop much of the technology leading to breakthroughs in commercializing fuel cells, advanced batteries, and electro-mechanical devices required for environmentally friendly, energy efficient means of transportation and manufacturing. And Los Angeles will be among the leading markets in the world for this technology. But it is also likely that many of these products will be manufactured in other regions, and that Los Angeles will not get these jobs, unless Los Angeles becomes more effective in commercializing the technologies it develops. In the area of fuel cells, for example, Japan is behind in the technologies now being developed in Los Angeles, but is investing several hundred million dollars a year in fuel cell development to establish a dominant presence in this market.

A Consortium for Clean Energy and Power Sources is being formed by the University of Southern California, the California Institute of Technology and the University of California at Los Angeles. The purpose of this Consortium is to accelerate development and commercialization of energy and power technologies being created in their laboratories.

These universities have requested that the County of Los Angeles support their effort. The Consortium's mission is to develop new, environmentally friendly, sustainable, and efficient fuels, energy forms, and power sources that will markedly enhance transportation systems, electric and gas utilities, and industrial processes. This Consortium is an opportunity to link the region's aerospace diversification efforts with what may well become the most advanced and innovative program for energy research and technology commercialization in the world.

The need to build an alliance for technology commercialization that includes not only industry and government but also universities was documented in Chapter 5, based on an investigation into the capabilities of aerospace firms to diversify into commercial markets without public sector assistance. One of the key findings was that the public sector will need to become a more active player in diversifying the region's high technology industrial complex through financial pump priming and establishment of long term, collaborative goals. This is not a role local government is currently equipped to take on by itself. The three major research universities of the region, the California Institute of Technology, the University of California at Los Angeles and the University of Southern California, have the knowledge base and public benefit orientation needed to help the public sector make choices about industrial policy in the advanced technology sector.

The Center needs two kinds of assistance to help it become a reality:

1. Public recognition and endorsement.

2. Help in obtaining start-up funding.

The Center would be valuable for growth of the County's economy, because it would

- Link the County's economic adjustment program with what may well become the most advanced and innovative program for energy research and technology commercialization in the world.

- Build the technological base required for development of the electric car and would bring funding into the County for developing that industry.

- Form the organizational base for implementing policies of the California Council on Science and Technology within Los Angeles County, thereby stimulating the growth of our most technologically advanced industries.

- Become a vehicle to assist local government in making choices about complex technological issues related to economic development in the advanced technology industrial sector.

- Provide a forum for building the partnership between academia, government and industry that is essential for diversifying the aerospace industry and facilitating high technology commercialization in Los Angeles County.

The charter for the Consortium for Clean Energy and Power Sources is attached. It includes a listing of research and development projects currently proposed. The Consortium is designed to work collaboratively with industry, and therefore seeks industry participation in these projects, as well as new projects proposed by industry. Awards of funds to research projects within the participating universities as well as to firms in the region would be done through merit-based selection procedures.

RECOMMENDATIONS

1. Award a grant of economic adjustment funds, to be matched by equal contributions from the three participating universities, to support start-up operations of the Consortium for Clean Energy and Power Sources.

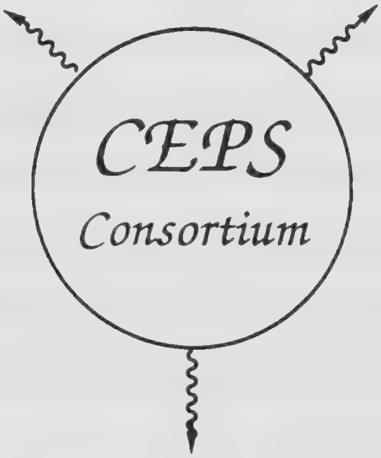
2. Use the Consortium to represent the universities of the region in working with government and industry to formulate the industrial development policy recommended in Chapter 9.

CONSORTIUM for CLEAN ENERGY and POWER SOURCES

founded by

California Institute of Technology

University of California, Los Angeles



University of Southern California

Cooperatively with
The COUNTY of LOS ANGELES

Administrative Offices: California Institute of Technology
Pasadena, CA

DESCRIPTION AND BACKGROUND

California, and in particular, Southern California, centered as we are by Los Angeles County, through the inventiveness and creativity of its people, has and continues to be a world renown center for education, the arts, scientific discovery and accomplishment, and for industry. Indeed, it is a world leader in industry and commerce.

Los Angeles County is especially endowed with many wonderful assets including a highly skilled work force, industrial facilities, and a supporting industrial infrastructure second to none. Los Angeles County continues to be at the forefront in its educational resources having three major research universities which are among the most distinguished in the nation and all of which are members of the Association of American Universities. The AAU includes only 56 prominent universities out of the 3500 colleges and universities that are within the United States.

Further, in recognition of these assets, Los Angeles County, being progressive in its leadership, has taken the initiative to work cooperatively with these three major universities to establish this Consortium which will provide focus for scientific endeavors and will accelerate the transitioning of innovations, discoveries, and inventions, to commercialization. In brief, this Consortium has, as one of its principal charges, the initiation and development of new and unique clean energy and power sources and to help, in

cooperation with industry, with the development of industrial applications that will further enhance Southern California's leadership as one of the most creative and successful industrial centers of the world. Thus, the Consortium constitutes an alliance of universities, government, and industry in Los Angeles County which will work together to bring research and exploratory development to commercialization that will be of profound benefit to the citizens of the County of Los Angeles, to the State of California, as well as to our nation and ultimately the world.

PURPOSE

Residents of Los Angeles County, as well as the State of California and the rest of the nation, are keenly aware of environmental concerns and are knowledgeable about the numerous efforts underway to both improve and maintain the environment. Further, we are keenly aware of our declining oil reserves and our dependence on imported oil. In addition, we are witnessing the decline of the defense/aerospace industry as well as other related technology and manufacturing industries both in our county and state. Thus, there are serious problems at hand including unemployment, loss of tax base, potential oil shortages, the requirement of more and more electrical power with an increasing population as well as environmental difficulties. The establishment of this Consortium will take advantage of our many assets and provide a concerted and dynamic approach to focus on these interrelated problems that we face. The Consortium, while serving

to integrate our many and varied resources, will not only contribute to solving present and future problems in areas of power and energy sources as well as the environment, but will also help to establish new industries which will lead to numerous employment opportunities and a vigorous economy.

OPPORTUNITY

Southern California, and in particular, Los Angeles County, are, by their unique conditions and circumstances, clearly the nation's laboratory and test-bed to pursue, develop, evaluate, and implement new solutions for our energy, power, and fuel problems, while controlling their environmental impact and adaptability. Close coupling with participatory industry and with governmental programs will enhance technology transfer and insertion that will result in the accelerated establishment of new industries. The availability of a highly skilled work force, quality facilities, and a vast supporting industrial infrastructure, will accelerate this industrial development.

STRATEGY

To meet the challenges at hand and more fully take advantage of our opportunities and resources, the formation of a scientific and engineering Consortium that is closely coupled with government agencies in the Los Angeles area, local universities, and participatory industry is planned. This Consortium will pursue the development of

new fuels, energy forms, and power sources that are environmentally friendly, sustainable, and efficient, that will markedly enhance transportation systems, electric and gas utilities, and industrial processes while enhancing our quality of life and that will lead to their commercialization and the initiation of new industries.

Importantly, the Consortium will be the catalyst to bring together leading scientific teams and world class engineering and development teams with dynamic industrial teams that are self selecting and participatory via an outstanding infrastructure. The Consortium will accomplish its missions by building and sustaining a three way partnership between universities, local government and industry. This approach, which is illustrated in Figure 1, will provide a world class problem solving environment that will enable the successful pursuit of key thrusts which will have major impacts in the energy and power sources fields as well as significantly influencing these areas via new industries that will be established. Further, the Consortium will work in collaboration with the California Council on Science and Technology. It will play an active role in implementing council policies in the Los Angeles area.

Thus, the Consortium will adopt an aggressive strategy and course of action to help integration of discovery, development, and commercialization of various requisite technologies for the development of an experimental hybrid electric vehicle that will have high performance and consumer acceptability. Other technologies being developed include improved and alternative clean fuels,

industrial processes for their manufacture, solid state batteries, high efficiency fuel cells to directly convert hydrocarbon fuel to electricity, advanced photovoltaic energy systems, and systems engineering modeling, and optimization required for electric vehicle development and commercialization. Matters dealing with public policy and resource management are to be incorporated in the industrial thrust developments as well as a systems approach.

STRUCTURE

For each principal thrust, a team leader is selected and is responsible for its management. The team leader reports to the Director who has overall responsibility. The Director is responsible to the Board of Governors. The Director also works closely with the Advisory Board and the Scientific Council.

Appointment to the Board of Governors is done jointly by the actions of the Presidents of the three universities upon recommendations by their respective Provosts or Chief Academic Officers. It is expected that each President will nominate several candidates for the Board of Governors. Three nominees of each President, with the concurrence of the other two Presidents, will be appointed to the Board of Governors. The Board of Governors appoints the Director who serves for a five year term. The Director selects an Executive Director who is principally responsible for administrative and financial matters but who can also act in the absence of the Director. The Advisory Board and the Scientific

Council are appointed by the Board of Governors with assistance from the Director. At the end of this section a proposed structure is shown.

Through the utilization of support structures within the three universities, the Administrative Staff is to be small. For example, it is planned that one of the universities will provide financial structure and oversight. As funds come to the Consortium they will go into a Consortium Account. Disbursements would be made with oversight by the university from this account.

The Consortium will both consider proposals for support and will also submit proposals to outside sources for the support of Consortium thrusts. Initial funding, which the County of Los Angeles supports the Consortium in obtaining, will enable the establishment of the Consortium and position it for intensive fund raising. Proposals will be developed cooperatively by Thrust Area Team(s) and will be submitted to various federal, state, and local agencies as well as to private foundations and philanthropists.

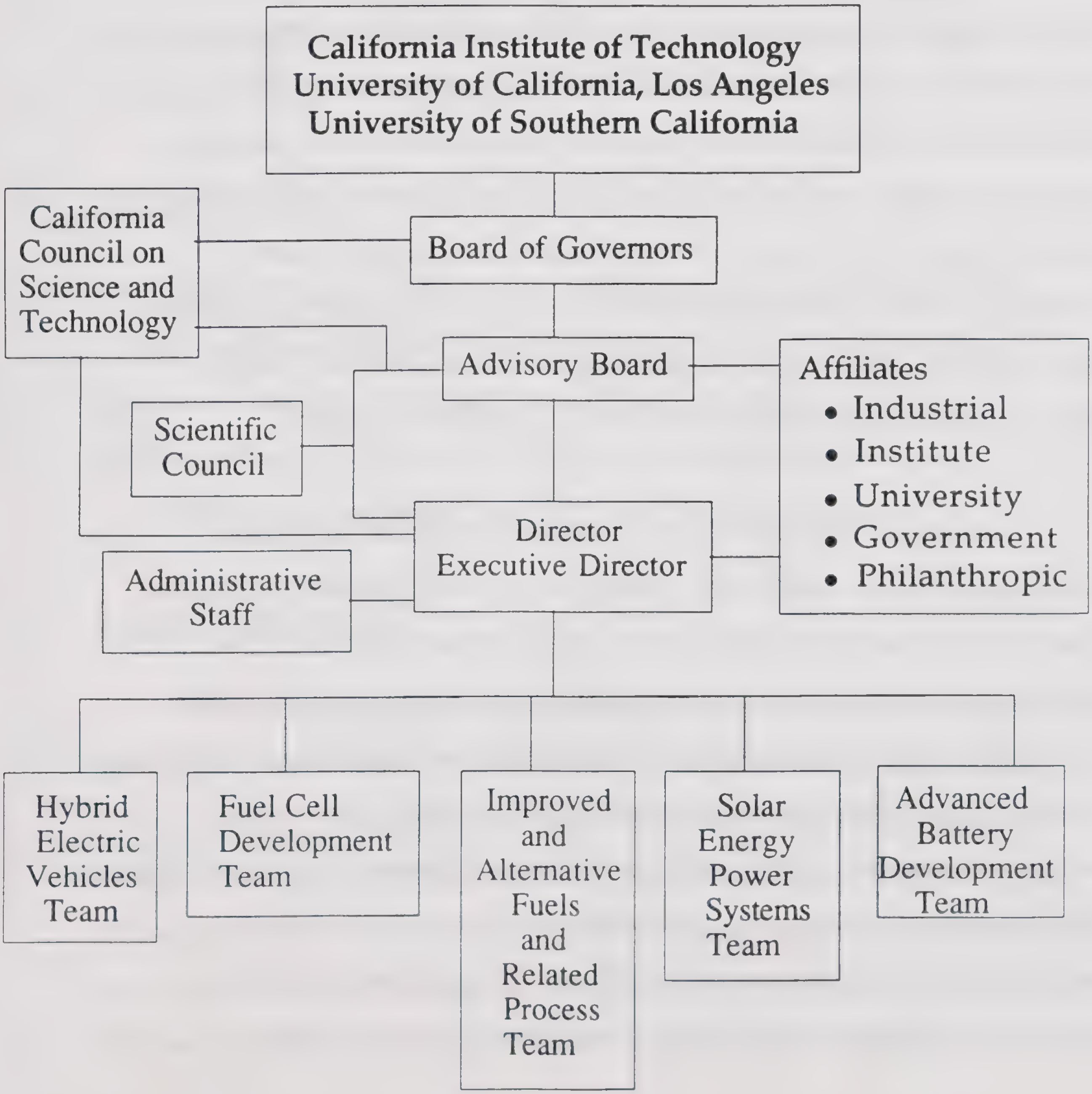
During the establishment of the Consortium, a Prospectus and Business Plan will be developed that will constitute the key components of a Promotion Package. With this Promotion Package in hand, extensive efforts will be committed to developing industrial,institute, philanthropic, and government affiliates whose support is central to the full exploitation of the resources and potential of the Consortium.

The Consortium is to be created formally by signature of participating institutions upon completion of a jointly agreeable Compact giving the Consortium's operating arrangement tangible form.

Participation by industries will enable the Consortium to help to affect interchange from ongoing research and development activities to commercialization. Participating industrial affiliates will participate early on in R&D activities and thus there will be industrial pull that will facilitate industrial development.

STRUCTURE

Center for Clean Energy and Power Sources



IMPACT

The major impact of the Consortium will be to help the creation and establishment of new industries that result from new technologies emanating from focussed innovative research and development activities. Not only will employment opportunities be substantially increased, as well as our commerce, but we will also greatly extend the usefulness of our limited petroleum resources while enhancing the air quality in the Los Angeles Basin. For example, a major impact will accrue to the electric utility sector as environmentally safe and efficient fuel cells, batteries, and solar energy sources provide for more efficient distributed power. Advanced fuels will enhance the air quality in Southern California and thus will have a great impact on our health and well being. Hybrid electric vehicles will also have a profound impact.

The unique approach by the Consortium will enable the acceleration of the discovery, development, and commercialization of environmentally adaptable energy and power sources. Often, pioneering research results are not pursued to their applications. They may sit for long periods on the shelf before there is an effort for practical demonstration or prototyping. As a result, the transitioning process to commercialization is drawn out over many years and often there is no commercialization. As a result, this nation loses out in many world markets. It is our belief that by coupling *world class* scientific and engineering teams with

participating *world class* industry and with local government, that this process will be dramatically enhanced and the time for research and technology insertion markedly shortened. Need by commercial entities self committed to bringing pertinent technology to market will accelerate the process. Further, through the identification and solution of barrier problems which are pursued with a view toward long term commitment and continued focus and by creating transitioning opportunities with participating industry, these significant impacts will result.

LEGAL ISSUES

It is necessary that various legal aspects be explored at the outset and that issues such as ownership of intellectual property rights and patents be determined and agreed upon. A legal framework is to be developed with the establishment of the Consortium and agreed to by the founding universities.

INITIAL FUNDING

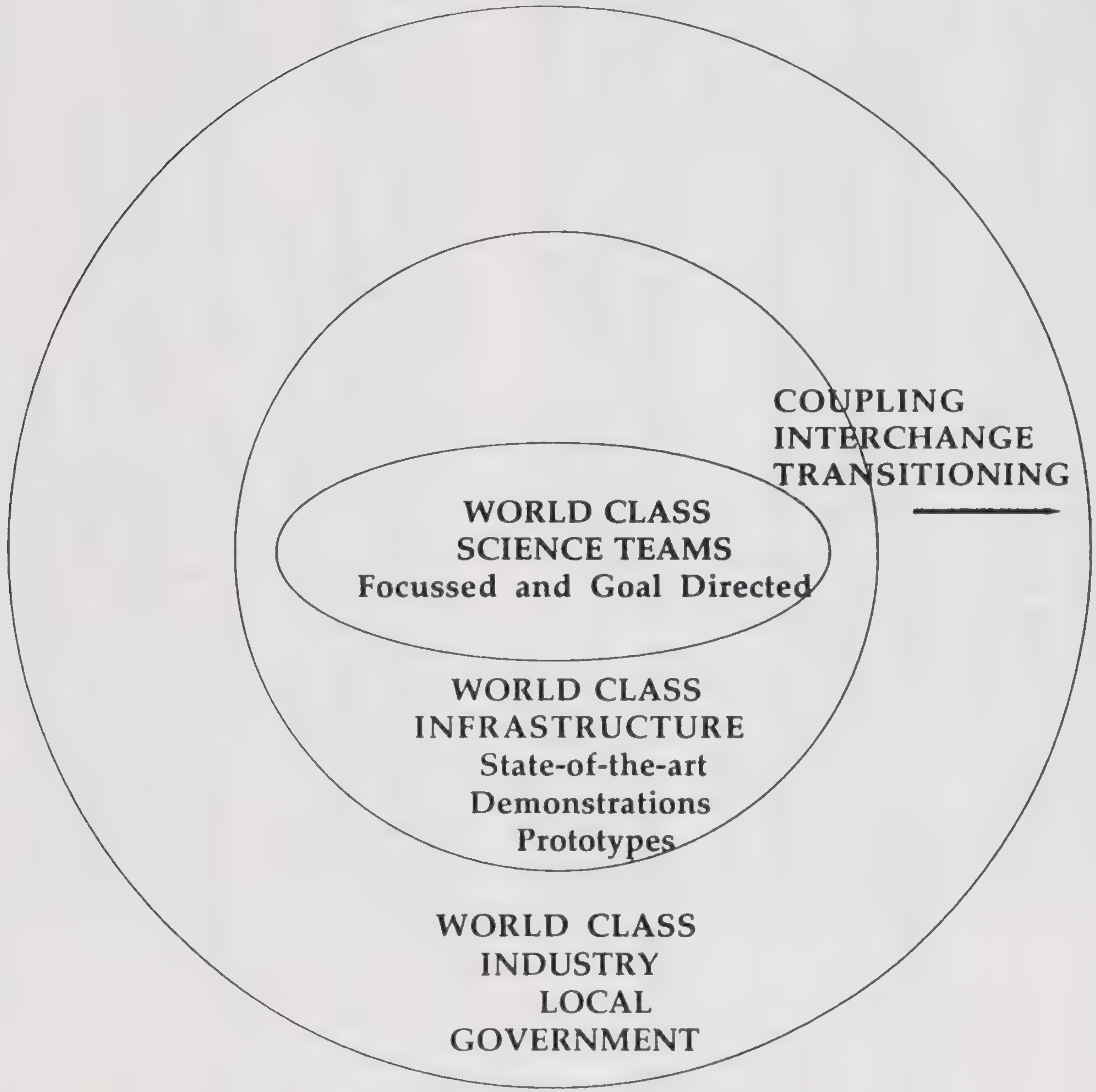
Seed funding sufficient to establish the Consortium and to initiate the key Thrust Programs will be obtained with assistance from Los Angeles County. It appears that Los Angeles County can assist in raising $450,000 which, with matching funds from the three Universities, will yield $900,000. This will enable the Consortium to become established and operational and to initiate two or three key thrusts. Out year funding from local public sources will be

determined during this first year as it will be dependent upon success in raising revenue from the many possible sources cited above. A plan and course for payback of public funds is to be developed during the establishment of the Consortium.

MISSION

Discover, Develop and Commercialize Alternative Fuels, New Industrial Processes, and Environmentally Adaptable Energy and Power Sources

FORMULA



RESOURCES

Talents and Assets of Cal Tech, USC, UCLA, Participating Industry, and Local Government

SUGGESTED PROGRAM THRUSTS

- Development of Clean Burning Alternative Fuels from Natural Gas via Alkane Activation Chemistry
- Development of Cleaner Burning Diesel Fuels through the Development of New Mixing Components and Additives and Supercritical Fluid Extraction of Carcinogenic Polycyclic Aromatic Hydrocarbons
- Development of Direct Oxidation Fuel Cells for Hybrid Electric Vehicles and Distributed Power via Development of New Catalysts for Fuel Oxidation and Oxygen Reduction and Novel Electrolytes from Super Acid Chemistry
- Development of Low Cost, High Efficiency Solar Energy Power Systems via Advanced Photovoltaic Cells and High Performance Networking of Cells and Advanced Manufacturing
- Development of Advanced Batteries for Hybrid Electric Vehicles via the Development of High Performance Polymer Electrolytes, Advanced, Lightweight Current Collectors, and More Efficient Cathodes
- Development of Advanced Filtration Technologies and Novel Polymeric Binders for Separation of Toxic Components from Air, Ground and Surface Water via Novel Carbon Chemistry and the Development of Hydrophilic Hydrophobic Block Copolymers
- Social and Environmental Impacts of Clean Energy and Power Sources, and Associated Questions of Policy.

TASKS AND MILESTONES

TASKS	MILESTONES			
Accelerate Fuel Cell Development Catalysts-USC, Cal Tech Electrolytes and Separators - USC, JPL Oxygen Reduction- Cal Tech Prototype Development and Testing - JPL			Test Methanol Fuel Cell	
Fuel Cell Performance Envelope for Hybrid Electric Vehicle - GM/AV				FULL
Accelerate Development of Solar Conversion Devices - Cal Tech, JPL Solar Panel Accommodation Envelope for Hybrid Electric Vehicle - GM/AV			Test Solar Panel	
				SCALE
Accelerate Solid State Battery Development Electrolytes - USC, JPL Anodes and Cathodes - USC, JPL Current Collector - USC, JPL Develop Battery Testing and Prototype Cell Facility - JPL			Test Battery and Initiate Scale-up	OPER-ATION
Battery Performance Envelope for Hybrid Electric Vehicle - GM/AV				
Develop and Test Alternative Fuels for Performance and Economy in Fuel Cells - USC			Test Fuels in Direct Oxidation Fuel Cell	
Establish Center Office at Cal Tech				
Form: Board of Governors Management Council Scientific Council				
Development of Three Year Prospectus and Business Plan	Promotional Plan and Strategy			
Development of Industrial, Institute and Government Founders			Funding Sources	
Development of Proposals	Proposals			
Review of Center Status Development by Above Board and Councils		Review	Review	
Start	3 Months	6 Months	12 Months	

Chapter 12

TECHNICAL ASSISTANCE AND SEED CAPITAL FUND

A STRATEGY FOR NEW BUSINESS OPPORTUNITIES

By Elizabeth Reid

OVERVIEW

High technology employment growth and diversification opportunities for the next five years are concentrated in new businesses and established small and medium-sized advanced technology firms. Chapter 5 of this study revealed that the highest priority for enhancing these opportunities and facilitating technology commercialization is the provision of seed capital and technical assistance for research and development projects and aerospace spin-off ventures. Financing is frequently unavailable for these projects because the traditional investor or lender is unable to accurately assess the technology and its potential applications. High quality technical assistance will required to help ensure successful investments. Engineers and scientists applying for seed money may have no previous management experience and will need expert advice in order to put together and carry out a sound business plan.

TECHNOLOGY DEVELOPMENT PROGRAM

Objectives

By developing well targeted yet flexible technical assistance and seed capital programs, the County can strengthen and diversify the local economy. These programs should be designed to spur near-term results while also encouraging long term economic development. Through technology development efforts that leverage university resources and private sector participation, these programs can stimulate growth of new technology-based firms and help established manufacturers throughout the County adopt new process technologies to become more competitive. The technical and financial assistance programs should have five main objectives:

1. Diversify the County's industrial base by developing new technology-based companies.
2. Focus on regional strengths and needs.
3. Encourage joint research and development between universities and the private sector.
4. Develop entrepreneurial skills and outlook.
5. Develop a technologically skilled workforce.

Staffing and Organization

The County should choose a single entity to operate the program which will staff it with highly qualified individuals whose time is devoted solely to the program's development and activities. Staffing the program with experts in various technical and investment fields is essential for its success. Expert skills are required for evaluating applications and providing assistance in order to reduce risks associated with loans and ensure that projects are satisfactorily completed. The program will need the high level of credibility gained through rigorous evaluation and expert technical assistance so that applicants receive validation that enables them to leverage matching funds from commercial and private investors. The Ben Franklin program in Philadelphia and Pittsburgh offers a good model for developing the County's financial assistance program.

Technical Assistance

A variety of business services should be provided at no or low cost to help Los Angeles County's small technology firms grow successfully. The package of services should be designed to meet the needs of early stage technology firms. Access to financing, small business incubator space, management guidance, accounting, bookkeeping assistance, legal guidance, assistance on obtaining federal research and development funds, and networking opportunities with other entrepreneurs should be among the services offered. Some of these services may be garnered from outside professionals on a *pro bono* basis with the potential of the firm as a future profitable client. Specifically the technical assistance should include the following elements:

Financing	Assistance with targeting capital sources and applying to the various capital funds, including those provided for in this program. Help identifying possible venture partners.
Incubators	Help locating or even providing affordable, flexible space and support services for entrepreneurs and start-up businesses.
Prototype Testing and Development	Help locating facilities for prototype development and testing.
Accounting	Providing assistance with bookkeeping, accounting, cash flow forecasting and other financial management issues by professional accountants on a *pro bono* basis or through workshops.
Legal	Arranging professional guidance on intellectual property rights and incorporation on a *pro bono* basis.

Federal R&D Awards	Assisting businesses in applying for Small Business Innovation Research (SBIR) funds and other federal R&D monies to bring innovative ideas from feasibility testing to commercialization.
Networking	Providing opportunities for exchanging ideas with other technology entrepreneurs through workshops, conferences, and receptions. Providing access to the Online Business Clearinghouse and assistance in locating scientific/technical experts.
Management Services	Assisting firms with management recruiting, business planning and marketing assistance through workshops, newsletters, and one-on-one assistance.
Education and Training	Linking firms with employee training and retraining programs. Providing seminars on productivity improvement, total quality management techniques and introductions to information technology.
Exporting	Identifying export opportunities through the Export Assistance Program

In addition to its own services, the technical assistance should make referrals to other appropriate agencies or assistance programs such as CEBRAC/BEAC, the State Department of Commerce's Small Business Loan Programs and Office of Competitive Technology, the Environmental Compliance Support Association (ECoSA), and South Coast Air Quality Management District's Small Business Assistance Program.

Seed Capital Fund

A seed capital fund should be developed with two programs: research and development projects and aerospace spin-off ventures. In each area of the program the key elements include: high risk lending, nonconventional repayment plans, and technical assistance in the application process and during the loan period. Six areas of industrial activities, identified by the aerospace survey as strengths of the region, should be covered by the programs: 1) environmental technologies; 2) electronics and communication technologies; 3) biotechnology; 4) transportation technology; 5) advanced materials, processes, and devices; and 6) computer applications. With each program there is substantial opportunity to leverage private and commercial money to help provide financing. Only activities within the County should be financed. Assistance should normally be withdrawn if the activity financed is moved from the County and financing should be recalled.

The program's support and approval of a seed capital application should signify to the financial community that a firm is a good investment opportunity with substantial commercial potential. In order to obtain such credibility and recognition, a rigorous evaluation process is needed. Two evaluation teams should be staffed: 1) a Technical Advisory Panel comprised of scientists and engineers: and 2) an Investment Advisory Panel comprised of venture and investment professionals. In addition, a business consultant should be retained to make an initial evaluation site visit to each firm that passes the screening of written applications.

Research and Development Seed Capital Program

Funding research and development (R&D) for existing or start-up high technology firms is an excellent way to take advantage of skilled and talented professionals being released from large aerospace firms by providing them with opportunities to start their own advanced technology firms or expand the R&D capabilities of existing firms. Currently large numbers of very talented professionals have been released from their employment with high technology firms and face very limited options for reemployment in the local area. New high technology or R&D ventures run by some of the best minds in the country could be formed from this skilled workforce. By capitalizing technology not only are new jobs created, but an important segment of the workforce is retained and reemployed at its full productive capacity.

Traditional financing for new ventures is difficult to acquire. Acquiring financing for a new venture when the borrower has had little or no entrepreneurial experience is even more difficult; acquiring financing for a new venture that may require a testing and prototype development stage of up to five years is nearly impossible. By investing in research and development, the County could assist the firms in raising other commercial capital and further developing the proposed product or process.

Research and development in six areas of technological innovation should qualify for funding: 1) environmental technologies; 2) electronics and communication technologies; 3) biotechnology; 4) transportation technology; 5) advanced materials, processes, and devices; and 6) computer applications. Researchers, inventors, or entrepreneurs should be eligible to apply for funds for applied research that is expected to lead to a commercial cash flow within three years. The following activities should be included:

- Proof of concept
- Exploratory development
- Prototype or technical demonstration
- Product/process development and movement to market

Projects that are limited to market feasibility studies or product marketing plans should not be eligible for funding under this program, but should be encouraged to apply to other existing small business assistance loan funds.

Eligible ventures should be based on a product or process that is already proven but still requires further research and development. The work of an R&D project might be carried out at a nonprofit institution (such as a university, hospital or government laboratory), company site, commercial R&D laboratory, or at multiple sites involving two or more of the above. While R&D projects of nonprofit researchers and cosponsoring private sector entities should be encouraged, the program should also fund projects undertaken solely by small companies or entrepreneurs starting new businesses. The program should assist in developing associations with university researchers as needed.

Proposals should be evaluated by a Technical Advisory Panel. In addition, once a proposal has passed an initial review, a due diligence visit should be conducted at the proposed site by a business consultant, and an additional review should be conducted by an Investment Advisory Panel. The criteria for evaluating a seed capital application should include the following:

- Potential for significant company growth
- Size of potential market and competitive advantage
- Technical feasibility and design or research plan
- Proposed commercialization plan
- Potential for near-term commercialization of product or process
- Potential for job creation
- Creation of new company
- Level of matching support
- Strength of management team
- Contribution to economic growth in exceptionally distressed parts of the County

The applicant should match at least one-half of the project costs from sources outside of the Research and Development Loan Program. Outside commitments are a measure of the depth of support for a project. Company resources committed to the project should be identified including the cash value of internal company activities directly related to the project and, in the case of joint industry/university projects, the value of all funds, equipment and materials supplied by the company to the university for its work on the project. Other sources of support are venture funds, foundations, federal and local government grants and contracts, and the resources of non-profit institutions, including universities. Collateral should not be required.

Projects which cannot be completed in one year should be eligible to seek up to two years additional support.

Many research and development seed capital recipients may be new to running a business or be small businesses trying to incorporate their new endeavor into current operations. In both cases access to technical assistance may mean the difference between success and failure of the enterprise. Therefore, entrepreneurs should be required to make use of the technical assistance available from the program during the application and funding period.

Entrepreneurial assistance should be made available to project applicants in a number of forms. Initial assistance should be provided to help applicants devise a viable business plan that best represents their proposal to the evaluation team. Literature search services, assistance with proposal writing, and technical evaluations should all be available to applicants. Technical assistance staff should help applicants gain access to facilities and equipment for R&D and locate appropriate scientific/technical experts for consultations or possible partnerships.

Once funding has been approved, entrepreneurial development services such as business planning, marketing assistance, accounting, legal and patent services, workshops and seminars, productivity improvement, and total quality management training should be available to the grantee.

Repayment of the seed capital should be based on a royalty of the product that was developed with the seed capital. Royalties should stop after the repayment amount is double or triple the loan amount.

Aerospace Spin-Off Capitalization Program

Aerospace spin-offs will facilitate the move of aerospace technology into market-oriented businesses, where it can be effectively commercialized and add to job creation. Interviews with large aerospace firms in the County suggest that their current structures hamper them in successfully commercializing their technology. Large firms in other parts of the country, facing similar situations, found that spinning off technology while retaining some equity in the new firm was the best balance of commercial venture and risk management. The new company consists of highly skilled engineers and technicians who might have been otherwise lost to the County.

As with much of high technology, the product development time for these start-up firms may be longer than with typical manufacturing start-up due to the up front R&D and prototype testing. The proposed technology may be beyond the understanding of traditional lenders and investors. The new company may also lack a track record as a successful entrepreneur. A venture capital fund which focuses on drawing technology out of aerospace firms should be developed to serve established firms interested in exploiting that technology. A seed capital fund and technical assistance, similar to the R&D seed capital fund, should be developed for start-up businesses interested in commercializing aerospace technology. Again, both the venture capital and seed capital managers should have a strong combination of expert technological and financial knowledge. These two programs could be important catalysts for diversification of defense-dependent firms and commercialization of their technology. In each case, the parent aerospace firm would retain an equity share in its intellectual property while at the same time supporting the development of a new small business to bring that property to a commercial market. The seed capital should be repaid, if possible, as a royalty on the product sold until the investment doubles or triples.

The technical assistance program should be made available to aerospace firms in a number of forms. Assistance should be given in identifying the strengths of the aerospace firm that have commercial potential. Analysis of viable market niches for proposed products, brokerage service to match technologies with interested investment and research partners and R&D facilities, assistance in setting up the spin-off, and help in the development of the intellectual property rights agreement should all be offered by the technical assistance program.

Additional Financing Programs
Small businesses are the future of high technology in Los Angeles County. Their growth is limited by inadequate resources, particularly financing. Various agencies, such as the Small Business Administration, Department of Housing and Urban Development, and the Department of Commerce, recognize this obstacle and have worked toward developing programs to provide small businesses with financing to meet their needs. These programs typically offer loan guarantees to commercial lenders, smaller principal amounts than available commercially, interest rate write downs, longer repayment terms, and technical assistance. Unfortunately, these programs still fail to meet the financing needs of a significant portion of viable small businesses. A loan program to meet the financial needs of small businesses might include some or all of the following program elements identified in this study:

1) **Reduced collateral requirements** - Many loan programs will require that the loan applicant put up their home as collateral. No matter how much the applicant may believe in the proposed project, putting up one's home and possibly a family's only security against an erratic economy is not reasonable. Rather than require such onerous collateral to cover the lender's risk, a thorough evaluation process should greatly reduce that risk.

2) **Unconventional loans** - Many firms' strategies for competitiveness are long term investments that are not necessarily devoted to fixed assets and do not immediately increase their income stream. These strategies can include developing customer feedback loops, plans for new market penetration, building export potential, and instituting quality improvement programs. These projects are not considered acceptable investments by most commercial lenders. The potential payoffs for these programs are potentially substantial as they result in the growth, flexibility and diversification for small firms.

3) **Environmental compliance loans** - Due to their lack of resources, environmental compliance is a great source of stress for small businesses. Many firms operate illegally because they can not afford the cost of compliance. These face fines in the thousands and tens of thousands of dollars; an amount that could cause a financial hardship for many small firms. Commercial lenders will typically not lend money for environmental compliance because the equipment installed usually does not increase the firm's revenue stream. In addition, loans for expansion, improvements,

and new property acquisitions undergo an exhaustive test for environmental liability to determine if the applicant is in compliance with applicable environmental regulations. If the firms is not found to be in compliance then the application is rejected, creating a "Catch-22" situation. A loan program that would guarantee commercial environmental loans would be a real help to small businesses.

RECOMMENDATIONS

It is recommended that the Los Angeles County Board of Supervisors:

1. Select an organization with expert qualifications to operate a Countywide technical and financial assistance program for small, high technology businesses within the operating guidelines specified in this chapter.

2. Allocate Economic Development Administration funds to the program to support operating, technical assistance, grant costs, and delegate responsibility to the selected organization to raise matching funds.

3. Conduct annual reviews of program accomplishments, strengths and weaknesses, and make any changes necessary to ensure that the program is effective. Effective financial and technical assistance should result in the identification and assistance of firms that predominantly remain in business, attract additional support and demonstrate some growth. Significant amounts of job creation should not be expected until five or six years after firms receive initial assistance.

Chapter 13

RECYCLING DEFENSE PRODUCTION FACILITIES

A STRATEGY FOR NEW BUSINESS OPPORTUNITIES

by Elizabeth Reid

INTRODUCTION

Defense cutbacks in Los Angeles County are putting at risk a wealth of facilities formerly used for aerospace production. Many of the aerospace firms going through consolidation find themselves with excess facilities that they must either fill with new production or put up for sale. These excess facilities offer a window of opportunity for matching physical infrastructure with emerging industries. Facility reutilization programs should be based on a careful evaluation of local industry strengths and manufacturing requirements of emerging markets. From this evaluation an adaptive reuse strategy can be formulated to leverage those strengths and recycle excess defense production facilities. At present, local government and commercial organizations are exploring whether clean energy transportation can become a future growth industry for Southern California. By investigating and understanding the sectors of that industry in which Los Angeles firms would have a competitive advantage, the County can assist local firms in obtaining a first mover advantage in this market. Recycling a defense production facility to meet the production and assembly needs of a niche market in the clean transit industry could stimulate the growth of new high technology manufacturing activity in Los Angeles County.

POTENTIAL SITES

One of the possibilities for defense production facility recycling government-owned, contractor-operated (GoCo) sites. There are two large GoCo aerospace manufacturing facilities located in the County: the Air Force's Plant 42 in Palmdale and the Navy's Industrial Reserve Ordnance Plant in Pomona. The Navy facility is currently operated by General Dynamics and serves as the production site for the Standard missile and Phalanx weapons system. General Dynamics is planning to move its Rancho Cucamonga operations to the Navy facility, which would put it near capacity. Plant 42 is at the heart of both military and commercial aerospace production in Los Angeles County. Although home to important contractor-operated production facilities such as Northrop's B-2 bomber and Lockheed's "Skunkworks[1]," Plant 42 could have significant idle capacity emerge because of the downturn in Defense spending. Budget constraints are also impacting facility maintenance and airfield operations.

[1] Lockheed is moving its Burbank Advanced Development Division in with its existing Palmdale operation.

The County has an opportunity to help preserve the valuable asset that Plant 42 represents and build a new advanced transportation development complex by bringing together agencies and organizations and individuals working to develop a clean transit industry in Los Angeles County. Plant 42 should be examined as a possible site for these groups converging to create a clean transit center with railcar, bus, and electric car assembly, as well as related research and development in such areas as composite materials and sensor equipment.

United States Air Force (USAF) Plant 42, Palmdale

Just off Highway 14 in Palmdale, Plant 42 sits on nine square miles of property and has two airstrips, rail spurs, eight production facilities, which each have as much as 1,000,000 square feet under one roof, and a workforce of 7,367. Plant 42 is immediately adjacent to Lockheed's Advanced Development Plant 10, Rockwell's Aircraft Operations plant, and Los Angeles City Department of Airports' undeveloped 16 square mile site for the proposed Palmdale International Airport, shown on Map 1.

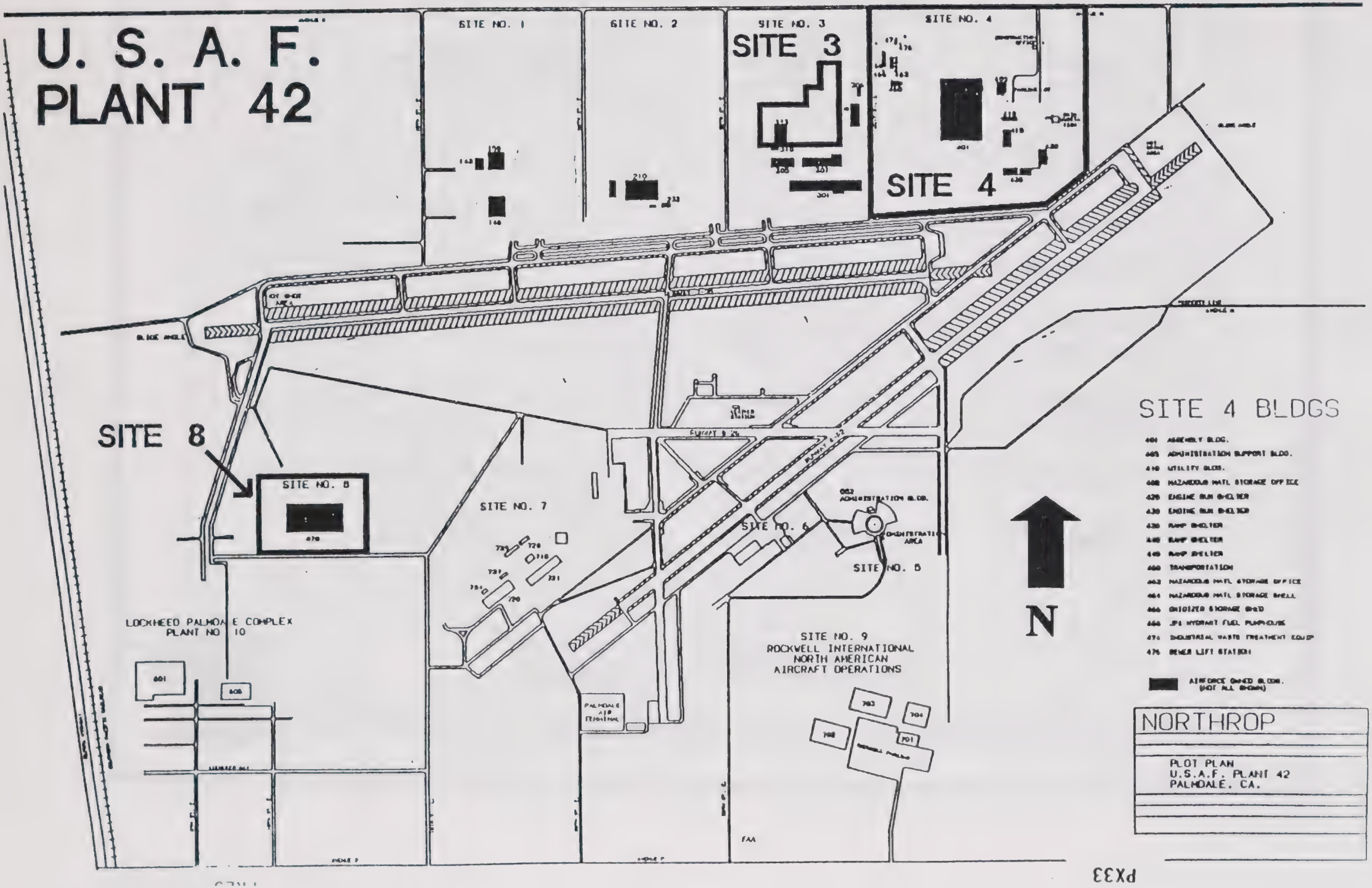
Although Plant 42 is operating at only 80% capacity, several production, modification and design operations are being conducted in its facilities (see Figure 1). If Plant 42 has to close its airstrip, the following projects are at risk :

Program	Customer	Contractor
Space Shuttle & Orbiters	NASA	Rockwell
TR-1 plane	AFLC	Lockheed
U2-R plane	AFLC	Lockheed
Nat'l Aerospace Plane[2]	DoD/NASA	Consortium
B-2 plane	ASD	Northrop
Classified	Classified	EG&G
F-117A plane	AFLC	Lockheed

The airstrip at Plant 42 is essential for these projects as planes are tested, flown in for modifications or repairs, and flown back out. In addition, Lockheed's Advanced Development Plant 10 and Rockwell's plant, which modifies B-1 planes, require access to the airstrip for delivery, testing, and return of aircraft.

Plant 42's airstrip is essential to more than just the production facilities on site and at its perimeter. McDonnell Douglas depends on the airstrip for the eight to ten federally required federal test flights of each of its new MD-11 airplanes. Air traffic congestion at Long Beach Airport prevents McDonnell Douglas from making its extensive test flights there. In addition, Skywest Airlines has located a terminal at Plant 42 that provides commercial flights between Palmdale and Sacramento.

[2]Design team.


U. S. A. F.
PLANT 42
SITE NO. 1
SITE NO. 2
SITE NO. 3
SITE 3
SITE NO. 4
SITE 4
SITE 8
SITE NO. 8
SITE NO. 7
SITE NO. 6
SITE NO. 5
SITE NO. 9
ROCKWELL INTERNATIONAL
NORTH AMERICAN
AIRCRAFT OPERATIONS
LOCKHEED PALMDALE COMPLEX
PLANT NO. 10
SITE 4 BLDGS
N
NORTHROP
PLOT PLAN
U.S.A.F. PLANT 42
PALMDALE, CA.
PX33

MAP 1

PRODUCTION FLIGHT TEST INSTALLATION
PROGRAMS

	PROGRAM	CUSTOMER	CONTRACTOR
SITE 1	SPACE SHUTTLE	NASA	ROCKWELL
SITE 2	TR-1	AFLC	LOCKHEED
	U2-R	AFLC	LOCKHEED
SITE 3	B-2	ASD	NORTHROP
	NASP	DOD/NASA	CONSORTIUM
SITE 4	B-2	ASD	NORTHROP
SITE 6	CLASSIFIED	CLASSIFIED	EG&G
SITE 7	F-117A	AFLC	LOCKHEED
	TR-1	AFLC	LOCKHEED
SITE 8	STORAGE WAREHOUSE	SHARED USE	PACIFICA
	EXPLOSIVE STORAGE	SHARED USE	PACIFICA

F2821.004

FIGURE 1

Los Angeles City Department of Airports projects that by the year 2005, Los Angeles International Airport (LAX) will have reached its capacity and need expansion facilities. Anticipating that need, the Department purchased 16 square miles of land adjacent to Plant 42. To facilitate the use of these two distant airports, the development of a high speed train between LAX and Palmdale is also in the planning stages. Planes using the proposed Palmdale International Airport may have to fly through some of Edward's USAF Base airspace. In order to delay this interference, the USAF has entered into an agreement with the Department of Airports allowing the planes to use Plant 42's airstrip until it reaches capacity at 200 flights in and out per day. This agreement has enabled the Department of Airports to delay construction of the Palmdale International Airport until there is sufficient demand to make the new airport commercially feasible.

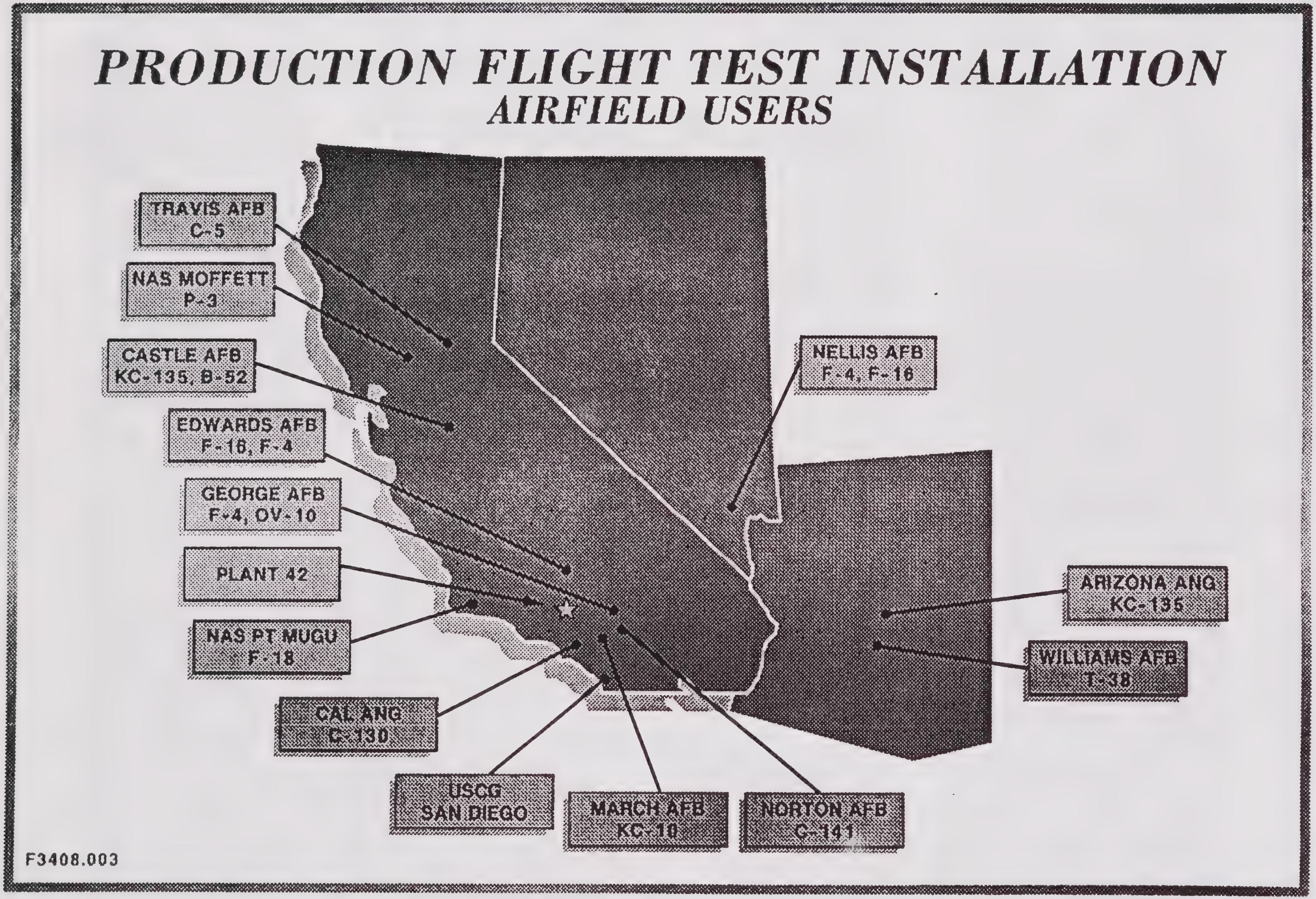
Plant 42's airstrip is also essential to the 13 military bases located throughout California, Nevada and Arizona (see Map 2). Many of these military bases are located in densely populated areas where residents have lobbied for and obtained many restriction on aircraft take-off and landing procedures to control noise impacts. Some bases also find their flight patterns constrained by local topography. Training pilots for military maneuvers requires a high degree of airspace freedom that is found at Plant 42. As a result, Plant 42's airstrip has evolved into a training ground for new and experienced military pilots.

The Current Situation for Plant 42

Cutbacks in defense production have caused Plant 42 serious hardship. With its contract for 75 B-2s, Northrop had anticipated making full use of Plant 42's two largest facilities, Sites 3 and 4, with approximately 1 million square feet of production space each. Now that production of the B-2 has been cut to 20 planes, Site 3 may go unused and employment at Plant 42 will drop by about 2,000. The reduction in B-2s also means a shorter production run for Northrop and they will vacate much of Site 4 earlier than expected. Unless a local firm wins the Navy AX fighter contract and decides to produce it locally, Plant 42 has no immediate prospects for filling Site 3. Site 8 is only half occupied, with Northrop using 250,000 square feet of the warehouse space for storage. With no new production contracts coming down the pipeline, management of Plant 42 is becoming very concerned about covering the costs of lost tenant income and maintaining vacant facilities.

In addition to overhead costs such as security, maintenance, and heating, Plant 42 is facing very expensive capital improvements if it is to keep its airstrip open. The landing and take-off lighting system for the airstrip requires frequent repairs and should be replaced. The landing strip that directly serves Site 6 and is used by Skywest and McDonnell Douglas needs to be repaved within the next five years at an estimated cost of $5 million.

To offset its declining military production tenancy and the upcoming capital expenses, Plant 42 is willing to consider commercial civilian tenants for its production sites, although


PRODUCTION FLIGHT TEST INSTALLATION
AIRFIELD USERS
TRAVIS AFB
C-5
NAS MOFFETT
P-3
CASTLE AFB
KC-135, B-52
EDWARDS AFB
F-16, F-4
GEORGE AFB
F-4, OV-10
PLANT 42
NAS PT MUGU
F-18
CAL ANG
C-130
USCG
SAN DIEGO
MARCH AFB
KC-10
NORTON AFB
C-141
NELLIS AFB
F-4, F-16
ARIZONA ANG
KC-135
WILLIAMS AFB
T-38
F3408.003

MAP 2

military and government programs still have priority. Plant 42 offers expansive facilities that have a range of uses, access to rail and air, a highly skilled and available local workforce, relatively inexpensive leasing rates, security, and proximity to leading aerospace firms. It is unlikely that foreign nationals would be considered as tenants due to the high security nature of current work at Plant 42.

Los Angeles County Transportation Commission

In a well-publicized policy decision, the Los Angeles County Transportation Commission (LACTC) rescinded its contract award to Sumitomo Corporation for the production of 21 railcars for the Metro Green Line to run between Norwalk and El Segundo. The rationale behind that decision was that during a severe economic downturn for Los Angeles County the contract presented an opportunity to leverage local jobs and to provide the catalyst for the creation of a railcar industry in Los Angeles County. LACTC drafted a six point action plan:

1. Authorize design of a standard rail vehicle - "The L.A. Car."
2. Require assembly of standard "L.A. Cars" in Los Angeles County facility to provide long term local employment opportunities.
3. Use "L.A. Car" on Metro Green Line to ensure earliest possible opening, with an option for later upgrade to incorporate more automation.
4. Authorize design of modules for future upgrades to automated, driverless technology.
5. Support state legislation authorizing local business preference, local assembly and domestic and local content transportation requirements.
6. Support federal legislation to improve U.S. rail car industry through the "American Railcar Industry Competitiveness Act of 1992."

While much of this action plan is still being revised, LACTC has already begun soliciting proposals from local governments and brokers for the railcar assembly site. In addition they are seeking a bus assembly facility that could be located with the rail car assembly site. The initial order for this facility will be 87 rail cars over three years. Approximately 7,000 buses will be needed in the next 30 years. The general requirements of the site are the following:

Rail Car Facility
- 8-10 acres
- 150,000 square feet covered
- Assembly space 600'l x 100'w x 50'h
- 20-30 acres for test track
- Access to rail
- 400 lb. floor
- 400 kw power supply

Bus Facility
- 8-10 acres
- 150,000 square feet covered
- Assembly space 600'l x 100'w x 25'h

The objectives of the LACTC initiative include helping to convert excess defense plant capacity and aerospace workers to peacetime endeavors. LACTC has already entered into several conversations with the real estate departments of several local aerospace firms, but the firms appear reticent about entering into agreements. The staff at Plant 42 is willing to consider locating those assembly operation at one of their sites. USAF Plant 42 is accustomed to assembly on this scale and has facilities that meet LACTC's general site requirements, including railspurs serving Sites 8, 1, 2, 3, and 4.

Advanced Transportation Competitiveness Act of 1991

The Surface Transportation Act of 1991, introduced by U.S. Representative Howard Berman (D-CA), authorizes $12 million in federal funds as one time grants to at least three consortiums dedicated to research and development of electric vehicles and cleaner transit systems. The grants are designed to act as seed money needed to capitalize on technological strengths and commercialize the needed technology.

Congressman Berman's office in Los Angeles County has recently organized a nonprofit corporation, CalStart, to promote a clean transit industry in Southern California using the electric vehicle as its first building block. CalStart is collaborating with the Amerigon Car Company to apply for one of the Surface Transportation Act grants to establish a prototype development facility for the electric car. An objective of this effort is to link the electric car with other efforts for clean transit technology that are taking place in the County. Vacant defense facilities are being explored by this group as potential sites for the electric car facility. Plant 42 has suitable facilities for this venture.

RECOMMENDATIONS

The County should carefully evaluate the strengths of local industry in light of requirements of the emerging clean transit industry. This evaluation will provide the basis for formulating an adaptive reuse strategy to leverage those strengths and recycle excess defense production facilities. Plant 42 should be included in this evaluation process because of its importance for the County's aerospace industry. Projects essential to local aerospace firms are dependent upon this unique government-owned facility. In addition, the 7,367 jobs that the Plant represents are essential to an area that employs only 2/3 of its resident workforce. The County has a unique opportunity to preserve the valuable asset that Plant 42 represents and help build a new advanced transportation development complex by bringing together agencies and organizations working toward developing a clean transit industry in Los Angeles County, but as yet still have separate action plans. Plant 42 could be the site where these groups converge to create a clean transit center with railcar, bus, and electric car assembly, as well as related research and development in such areas as composite materials and sensor equipment. It is recommended that the County

support an effective plan for recycling of defense production facilities, particularly Plant 42, by

1) Developing a strategy to address the potential of a clean transit industry being started in Los Angeles County.

2) Seeking Economic Development Administration funds to support commercial research, development and high technology manufacturing at Plant 42, or if that site proves infeasible, another defense-related facility in Los Angeles County.

3) Delegating responsibility to an organization within the County to be responsible for this project and carry out the action steps being recommended.

4) Encouraging the Los Angeles County Transportation Commission to consider Plant 42, or other excess defense production facilities, as a possible site for the assembly of their railcars and buses. EDA funds should be identified as a resource for subsidizing the cost of leasing or equipping the facility if that is what required to bring the LACTC operation to a former defense production site.

5) Presenting available space to CalStart and other electric car organizations and offering to subsidize conversion of a portion of Plant 42, or another previous defense production site, for electric car development, testing and assembly.

6) Leasing vacant space from Plant 42, or another former defense facility, and developing a small business incubator for clean transit that would include office space, prototype development, testing facilities, and light manufacturing space.

7) Working with LACTC and Cal/Trans to encourage the assembly of the El Segundo-Palmdale high speed rail at a former Los Angeles County defense production site, possibly Plant 42.

BUSINESS CLEARINGHOUSE AND EXPORT ASSISTANCE

A STRATEGY FOR NEW BUSINESS OPPORTUNITIES

by Katherine Bulow

BUSINESS OPPORTUNITIES CLEARINGHOUSE

The Aerospace Task Force determined that a Business Opportunities Clearinghouse is needed to

- Help aerospace firms fulfill international offset obligations.
- Disseminate information about business opportunities that don't match the requirements or business plans of the recipient company, but which might be of interest to other companies.

Overview

Clearinghouse System
The proposed Clearinghouse would be operated through California's Automated Trade Library Service (ATLS), which is housed in the California State University system. This one year old system currently has 11,000 subscribers who receive free access to export-related data bases providing country-market and industry research. The State Department of Commerce, which operates ATLS, has programmed a special subsystem at the request of the ATF to serve as a Business Opportunities Clearinghouse for the aerospace industry.

Services
The proposed Clearinghouse would collect and disseminate the following kinds of information from aerospace firms:

- Offset transactions which offer potential business opportunities for other firms.
- Foreign trade opportunities which the recipient firm does not wish to pursue. Those opportunities which are export-related would be disseminated throughout the entire ATLS network as well as the Aerospace Clearinghouse.
- Intellectual property which is available for sale or licensing.
- Specifications for technological problems which firms are seeking a vendor to solve.

A staff person should be assigned to the Clearinghouse to facilitate communication between firms, monitor the progress of referrals, and ensure that information in the system is current and accurate. This component of personal facilitation is essential to make the system highly interactive by drawing the attention of users to opportunities in a timely manner.

This kind of communication system for building business linkages among high technology firms in the Los Angeles area would help meet the need identified in Chapter 4 for more inter-firm collaboration to develop and commercialize new technologies.

Membership
Access to the Clearinghouse should be available to all aerospace firms doing business in Los Angeles County who are direct contractors with the Department of Defense or approved subcontractors. All members should be able to submit business opportunities to be disseminated through the Clearinghouse, and should also have access to all data bases in the ATLS system as well as the Aerospace Clearinghouse. In addition, export opportunities to be disseminated through the Clearinghouse should be accepted from all validated sources, including firms outside California.

Schedule
All hardware and software are in place for the Clearinghouse, so activity can begin as soon as funding is provided.

Technical Features
ATLS can be accessed by modem from any personal computer. It is supported by a SUN 470 computer equipped with approximately 1 gigabyte of high speed on-line mass storage, 32 megabytes of main memory, and SUN OS 4.1, an enhanced high speed variant of UNIX. The system can handle up to 128 simultaneous users. Features include: menu driven selection of options, on-line instant help for every system capability, system "macros", advanced search and mark capabilities, and file downloading and uploading using a variety of transfer protocols.

Background

Evaluation of the Automated Trade Library Service (ATLS)
A primary source of information in ATLS is the U.S. Department of Commerce's National Trade Data Bank (NTDB). ATLS includes trade leads from Commerce's electronic bulletin board, data base of foreign traders, country market plans, industry sector analyses, over 2,200 industry reports, bibliography of Foreign Commercial Service (FCS) contact people, trade fairs, trade shows, trade missions in California and government-sponsored events. ATLS contains "how to" information and is an excellent data base to help businesses identify potential market areas, contacts in those countries and develop pertinent demographic information.

Many ATLS users to date have been small- to medium-sized businesses. This data base contains excellent information to assist firms in ascertaining what markets they should target and helps them develop the strategy, contacts, and important country specific information such as tariffs, restrictions, and so on. ATLS contains trade leads from the U.S. Department of Commerce's Economic Bulletin Board which are primarily real time leads from U.S. operatives overseas and other government data bases such as member countries of EC-92.

ATLS does not contain project information available from the U.S. Agency for International Development (AID), U.S. Trade Development Program (TDP), United Nations Industrial Development Organization (UNIDO), United Nations Development Programme (UNDP), World Bank, Inter-American Development Bank, Asian Development Bank, and African Development Bank. These organizations make project information available but in most instances it is not in automated form.

In summary, ATLS is obtaining the majority of trade and export information available in automated form today. It is missing a few information sources described later in this chapter. ATLS has agreed to accept trade information from the Aerospace Task Force (ATF) on a prototype basis. This arrangement will permit direct input of trade related information received by ATF members which will be shared with other interested aerospace companies.

Review of Information Sources

Commercial Information Management System (CIMS)
Commercial Information Management System (CIMS) is available through U.S. Department of Commerce district trade offices. CIMS II is being prototyped and expected to be available in early 1992. The new system is a vast improvement over CIMS and will provide real time information from foreign commercial service posts; access to articles overseas; information on agents or financial institutions; and on-line with EC-92 countries' government offerings. CIMS will not be made available to the public except through Commerce offices although trade opportunities, project information, market research, and current country information will be available through the NTDB and on a daily basis through the Economic Bulletin Board.

National Trade Data Bank (NTDB)
The U.S. Department of Commerce's NTDB contains the largest array of data bases in the U.S. government and will continue to add trade information from other government agencies as appropriate. The data is timely since NTDB is updated monthly and is available on CD ROM. ATLS subscribes to NTDB.

U.S. Department of Commerce data bases included in NTDB are Census Bureau foreign trade data; Bureau of Economic Analysis foreign direct investments in the U.S., operations of U.S. affiliates of foreign companies, U.S. businesses acquired and established by foreign

direct investors, and balance of payments; International Trade Administration foreign traders index, market research reports and trade opportunity program (on electronic bulletin board); National Institute for Standards and Technology standards certification and metric information program.

NTDB is completing its first year of operation after Congress mandated the consolidation of trade information government-wide. It includes information from the Central Intelligence Agency, Department of Agriculture, Department of Energy, Department of Labor Export-Import Bank, Board of Governors of the Federal Reserve System, U.S. International Trade Commission, Overseas Private Investment Corporation, Small Business Administration, Office of the U.S. Trade Representative, and AID.

NTDB does not contain information from U.S. Trade Development Program, U.S. Information Agency, World Bank, African, Asian and Inter-American Development Banks, or United Nations organizations.

Commerce Business Daily (CBD)
The U.S. government requires publication of procurement and grant opportunities using U.S. government monies in Commerce Business Daily (CBD). The Agency for International Development, Trade Development Program and United States Information Agency publish request for proposals (RFPs) in CBD on overseas opportunities. While traditionally viewed as a tool for domestic opportunities, CBD does contain foreign opportunities such as construction of the U.S. Embassy in Lima, Peru, or hydroelectric plant in Costa Rica for U.S. businesses. CBD is produced five days a week and is available in electronic or print form for a fee. There are private sector firms that can produce trade specific information from the CBD data base. The cost would vary based on whether it is currently arrayed in a trade opportunity format or they need to create a separate program. Other State of California offices may subscribe to CBD electronically and could develop a separate program to produce trade opportunities from CBD and input that data into ATLS. Publication in the Commerce Business Daily is the final step in a government procurement opportunity.

U.S. Agency for International Development (AID) Funded Projects
AID recently started providing information to the Economic Bulletin Board portion of Commerce's National Trade Data Bank. Early 1991, AID instituted a review of clearinghouse services--information on business opportunities, specifically procurement, trade, investment and technology transfer opportunities--and business advisory services--information on trade and investment regulations and incentives in individual countries, and how to do business in these countries. The review demonstrated the lack of consolidated data bases within AID much less within the U.S. government and led to AID's establishment of a prototype of a Trade and Investment Monitoring System (TIMS). TIMS is currently being tested in 30 locations and AID will be making long-term deployment decision on the final product early 1992. TIMS has six modules with

information on country profiles, contacts file, trade analysis, sources of funds and general research and reference.

United Nations Development Business
Development Business is a bi-monthly newsletter which provides procurement information from the World Bank, the Inter-American Development Bank, the Asian Development Bank, and the African Development Bank. Development Business also provides 28 proposed project supplements and offers the opportunity to connect with their electronic edge, Scan-a-Bid. This newsletter appears to be the only centralized source of procurement opportunities from the World Bank and development banks because none are required to publish in Commerce Business Daily nor use U.S. businesses. The cost of Scan-a-Bid is $960 per year in addition to the subscription fee for Development Business.

United Nations Industrial Development Organization (UNIDO)
UNIDO's task is to encourage commercial development in developing countries. They offer a mechanism to bring promising entrepreneurs in the developing world to the attention of potential partners in industrialized countries through a world-wide network of investment promotion services. Their Washington office provides specific investment opportunities, information on industrial projects which may require foreign help in technology and marketing expertise, public and private sources of private financing, forms of industrial cooperation including joint ventures, leasing, licensing and limited partnerships. UNIDO conducts investment missions and investors forums. UNIDO data is not automated but they are interested in expanding their network within the U.S.

Information Sources That Should Be Linked To ATLS

There are two areas where ATLS does not provide information--inter-national procurement opportunities from the Commerce Business Daily (CBD) and project information from the World Bank, Asia, Africa, and Inter-American Development Banks. AID project information is now captured through Commerce's Economic Bulletin Board as of October 1991. Unless the State of California receives CBD and can develop a program to extract the trade information the CBD probably cannot be procured cost effectively. CBD gets some of their trade data from Commerce's Economic Bulletin Board (EBB), AID projects are in both CBD and EBB, thus, ATLS already receives this information. The only opportunities missed will be projects such as a State Department embassy construction or feasibility studies by the Trade Development Program (TDP).

The United Nation's Development Business publications and Scan-a-Bid on-line procurement data base captures project and procurement information from the World Banks, Asia, Africa and Inter-American Development Banks. This information would be extremely useful to the aerospace companies because it has proposed projects as well as actual procurement offerings. Unlike AID projects there is no requirement that U.S. businesses be awarded the contracts. However, from a strategic planning standpoint it

permits the aerospace industry to see what these international organizations are funding and make their own business assessments about what they want to pursue. These projects may be too large for small- to medium-sized businesses to compete for and consequently may not be appropriate for inclusion in ATLS.

CONCLUSION

ATLS is obtaining the best data available today and is willing to consider other sources as they evolve. The U.S. government continues to improve on their efforts to consolidate and capture trade-related data which will continue to benefit ATLS. AID's TIMS could be a valuable addition to ATLS once it is deployed and the United Nation's Business Development Scan-a-Bid should be reviewed in the context of usefulness to ATLS total client base.

EXPORT STRATEGY

The Export Strategy has four components. They are identification of sources of financial and technical assistance, description of existing laws and international agreements, export strategy models, and recommendations for an export strategy.

Financial and Technical Assistance Sources For Exporting

There is a broad array of financial and technical resources available to U.S. firms of all sizes interested in exporting (see Appendix A at the end of this chapter for full program descriptions). Financial export assistance programs available to U.S. firms include

- Loans
- Loan Guarantees
- Export Credit Insurance
- Investment Insurance
- Fixed Rate Financing
- Working Capital Guarantees
- Lease Financing
- Feasibility Studies Grants

These programs are offered by a variety of agencies including United States Export-Import Bank (Exim), Small Business Administration (SBA), U.S. Agency for International Development (AID), Overseas Private Investment Corporation (OPIC), and the U.S. Trade and Development Program (TDP). The international financial community, such as the International Finance Corporation (IFC) and the World Bank, also offers financial export assistance for U.S. firms interested in expanding into developing countries.

The U.S. Department has a multitude of technical assistance programs for U.S. firms interested in exporting. Up-to-date information on country-specific markets, trade regulations and industry trends is readily available to interested parties. Legal counsel and

consulting advice are provided through the SBA. Overseas offices are also available for contacting buyers and government officials.

Existing Laws and International Agreements

Export Trading Company Act (ETC) passed in 1982 and implemented by U.S. Department of Commerce with Department of Justice assistance, is intended to increase U.S. exports of goods and services by removing two impediments: (1) restrictions on trade financing and (2) uncertainty about the application of U.S. antitrust laws to export trade. The Act created unlimited possibilities for ETC formation options, it allows ETCs to be based on single or multiple products from various regions of the U.S. It does not restrict which industries or organizations can form an ETC. Diverse entities such as manufacturers, bank holding companies, service organizations, trade associations, public authorities, and foreign entities are eligible participants in ETCs.

The U.S. Department of Commerce's "The Export Trading Company Guidebook" provides detailed information on designing ETCs with hypothetical examples of models such as single product, trade stream, hub, bank holding company and single product area. The following chart from the guidebook summarizes the examples.

Table 7-1--Summary of Hypothetical ETC Examples

Models	Institutional Participants	Products or Services	Domestic Coverage	Foreign Market	Trade Volume
Trade Stream Model	Manufacturer Freight Forwarder BHC Entrepreneur	Narrow Product Line	Geographic Region	Single Country	$6.5 Mil. (4th yr.)
Single Product Model	Manufacturers BHC	Single Product Line	Nationwide	Worldwide	$10 Mil. (4th yr.)
Services Model	Architects & Engineers	Design & Management Services	Geographic Region	Geographic Region	$35 Mil. (4th yr.)
Hub Model	Port Authority Bankers Bank	Multiple Product Lines	Geographic Region	Geographic Region	$50 Mil. (4th yr.)

Models	Institutional Participants	Products or Services	Domestic Coverage	Foreign Market	Trade Volume
Bank Holding Company Model	BHC Ocean Shipper Insurance Co.	Multiple Product Lines	Single State	Worldwide	$65 Mil. (4th yr.)
Single Product Area Model	Manufacturers Equity Capital Organization	Single Product Area Line	Nationwide	Geographic Region	$250 Mil. (4th yr.)

The competitive advantages from joint export activities are:

Market research: Firms can join together to share the costs of foreign market research, travel, and overseas activities.

Market Development: Complementary products can offer "full line" packages to buyers; costs of trade shows, exhibits, advertising and so on can be shared.

Overseas Bidding: By bidding jointly, instead of against each other, U.S. firms can increase sales and profits. Through joint bidding, firms can respond to foreign orders requiring quantities or qualifications, beyond the normal capacity of the individual firm.

Transportation and Shipping: Carriers can be induced to offer volume discounts. By entering into joint shipping arrangements, firms can guarantee carriers sufficient cargo to negotiate these discounts. In some cases carriers are also willing to enter into longer term contracts which permits firms to quote prices with greater certainty.

Joint export ventures between domestic competitors might raise questions under U.S. antitrust laws. A provision of the ETC Act permits U.S. exporters to obtain antitrust immunity from Federal and State prosecution by having Commerce and Justice provide an Export Trade Certificate of Review for their export trade activities.

Approximately 130 certifications of review have been issued with over 5,000 firms covered.

Export Strategy Models

Formulating an export strategy that will help lessen the impact of Federal Defense downsizing in Los Angeles County will require a long range, comprehensive approach on the part of large, mid-sized, and smaller corporations. Both Japan and Germany have developed successful, well-organized export strategies that are worth examination.

Japan

Japan has been undeniably successful in its efforts to penetrate foreign markets. The basis for this success is a very collaborative domestic model for exporting Japan's goods that they term "sogo shosha." The sogo shosha are described below, along with points of comparison with U.S. practices.

- Size

  Sogo shosha are the nine large Japanese trading companies. They have combined sales of $700 billion and account for 50% of Japan's exports and about 60% of its imports. For the year ending March 1989, Mitsui had $126 billion in trade transactions. In contrast, almost 70% of U.S. trade intermediaries had gross annual revenues of less than $5 million.

- Organization

  They are organized along product/industry lines - not along geographical lines.

  Each is affiliated with a large industrial conglomerate centered around a major urban bank.

  Most have manufacturing subsidiaries or affiliates, they serve as conduits for technology transfer from the West through licensing agreements negotiated for their manufacturing subsidiaries. In the U.S., there is very little cross ownership between manufacturers and trading companies.

  Unlike U.S. trade intermediaries, most of which handle a limited number of products, sogo shosha deal with a multitude - Mitsui handles as many as 20,000 different items.

  Whereas U.S. hiring practices focus on the selection of persons with technical or functional skills, the sogo shosha emphasize skills in international relations and foreign languages.

- Operations

  The sogo shosha acts as intermediaries between buyers and sellers at all stages of product and trade flow - from upstream raw material extraction, through production to downstream distribution to end user. The heart of their strategy is search for volume growth They are very flexible and willing to play whatever role is necessary to make the project or transaction work - trade catalyst, joint partner, consortia organizer, project and turn-key plant management. U.S. firms do not possess similar capabilities.

- Financing Capabilities

  Sogo shosha derive significant financial strength from an associated bank (often a major stockholder). They borrow from the bank to acquire or establish firms to

obtain a production base or resource development. They also re-loan funds to clients. In 1987, the sogo shosha provided over $26 billion in trade credits and $47 billion in long-term loans and credit guarantees. It is not unusual for 60-70% of a sogo shosha's assets to be committed to financing suppliers and customers. U.S. firms do not have this kind of financial strength; most are thinly capitalized and U.S. banking laws preclude the relationships enjoyed by the sogo shosha and the urban banks.

- <u>Communications</u>
  Sogo shosha have vast communications networks and an extensive presence in the foreign markets. For example, one sogo shosha has 190 offices worldwide with 20 in the U.S. alone. In contrast, very few U.S. trading companies even have an overseas office.

Lessons Learned from Japan
The sogo shosha were born and raised in a unique historical environment. They also reflect cultural differences. Unlike U.S. firms that prefer to "go it alone," Japanese firms see the value of trading companies and use them accordingly. A possible alternative that might be better suited for Los Angeles' business environment would be formation of a consortium of U.S. companies, subject to constraints of U.S. antitrust and banking laws. The most important lesson to be learned from the sogo shosha is their philosophical approach to trade--willingness to identify and <u>initiate</u> projects; willingness to be flexible in the role they play; devotion to understanding international relations and learning foreign languages and cultures; and, the willingness to invest in the deal before reaping the profits.

Germany
Japanese trading companies and industrial groups have often been held up as organizations for U.S. corporations to emulate, but there is a rising group of executives that think the German model of export (Germany is the world's leading exporter) in which fiercely independent small and mid-size companies produce two-thirds of Germany's gross national product, train 9 out of 10 apprentices, and employ 4 out of 5 workers is the way to go. Large corporations work in close concert with small and mid-size companies, using them as suppliers and providing export information and technical assistance in a close working relationship. At $1.4 trillion, Germany's economy is less than a fourth the size of the United States and its work force of 34 million is dwarfed by America's 115 million. Yet, last year Germany sold $421 billion work of exports, $27 billion ahead of America's $394 and well ahead of Japan's $286.

Germany has developed it exporting philosophy since the second World War. As a manufacturing nation Germany's internal markets cannot sustain its own production so it has had to look overseas. Their export philosophy is one with long term vision and consistency and it has proved highly successful. German middle-sized firms concentrate on quality, profits, and long-term ownership rather than quarterly profit earnings. They place a major emphasis on training and on handing a healthy company to the next generation.

In Germany, diplomats, bankers, trade association officials and chambers of commerce form a formidable network in dozens of countries helping to spot, process, and finance export orders. They funnel details of potential export deals to companies back home via newsletters and data bases. German embassies aggressively promote exports and trade and industrial associations to facilitate their members' sales overseas. Trade associations, export trading companies, and banks help with documentation, translation, legal, and shipping services. They also provide office space and secretarial help in distant markets. Specialized banks or departments in large banks that concentrate on mid-size companies provide export finance and arrange credit and political risk insurance through government-backed export credit agencies. Industry associations produce standard contracts translated into different languages and offer legal assistance in reading foreign contracts at no charge to members.

They also allow German companies to use their overseas offices when negotiating deals, especially in places where the infrastructure is poor. Banking systems are also sensitive to the needs of exporters and may offer offices and secretarial help when firms are prospecting for business in distant markets.

Lessons Learned from Germany

The depth of U.S. resistance to exporting is great and a concerted educational effort to overcome this philosophy is needed. A U.S. Department of Commerce survey found that many smaller companies do not have a basic knowledge of world markets, do not want to go on trade missions, and do not want to translate their sales materials into foreign languages--all basic requirements for successful export. The U.S. domestic market is diminishing from the peace dividend, the recession, and the competitive global economy and it is now time to reexamine and aggressively enter overseas markets. A strong outreach effort is needed to convey the message that U.S. companies must go overseas.

The U.S. has all the ingredients to replicate the German model in place, it merely requires a different spin and focus on the problem. The U.S. has export trading companies, trade associations, international banking, U.S. embassy and foreign commercial services, and a government/commercial delivery system.

Southern California businesses, universities, and local governments can form alliances to build export coalitions based on the German model. A model is being put together in Pittsburgh and several trade associations--the American Electronics Association and the Machine Tool Makers Association--are working to encourage their members to export. Another successful model is the New Jersey Port Authority which is a public private sector trading company.

A key factor of the German success, and one that is indicated for U.S. success, is willingness to invest substantial money into research and development, to use innovation and applied research to overcome high labor costs in the world, and to battle the strong U.S. dollar that makes U.S. exports more expensive.

Small U.S. companies would be helped by funding from government subsidies, such as the Small Business Innovative Research (SBIR) grants, tax credits, and by financial institutions. German companies with annual sales of less than $590 million can get grants covering 40% of developing and implementing modern biotechnology production methods. There the growth in research and development outlays for companies with fewer than 1,000 employees is 21% a year. Nearly two-thirds of German exports are technology intensive.

Another technique is to search out and target smaller but rich markets and to take ideas into the market in the fastest, most time efficient way--to move quickly to find, fill, and dominate new market niches.

Large Corporations
This is where a carefully planned and coordinated long term approach is needed. Leadership is needed with a well defined agenda. Large corporations can work to increase their own markets in major overseas projects as well as make a commitment to work with their mid-sized suppliers in the U.S. to increase U.S. export opportunity overall.

U.S. companies with an offshore presence often come across leads, opportunities and contacts that are not germane to their own business. With an aggressive "Think America" program of export promotion, they could communicate this information on an ongoing basis back to domestic businesses for trade possibilities. A Los Angeles-based organization is needed to facilitate developing those leads into business opportunities (e.g., using the ATLS system for dissemination of the leads).

In addition, looking at the German model, large corporations can provide office, technical, and secretarial backup to firms from the Southern California area as they explore opportunities in overseas markets--provide introductions to banks, contacts, etc.

It is also timely for corporations and local governmental economic developmental agencies to reexamine the role of existing U.S. trade and industry associations, port authorities, and export trading company models for use in developing and implementing exporting strategies. The U.S. has many of the German tools in place today and they simply need to be redirected to complement export promotion strategies.

Existing financial and governmental support is already located in Southern California from such entities as Exim Bank, the Small Business Administration, California's ATLS System--a data bank that contains all of the U.S. Department of Commerce information, as well as country profiles, and comprehensive worldwide market information.

Major opportunities exist for large corporations with World Bank projects. This is a market that has rarely been seriously cultivated and nurtured by major U.S. corporations. This year alone the World Bank will lend over $23 billion to projects worldwide. With an increasing proportion of the Third World's outstanding official debt, the bank has extraordinary leverage to shape development strategies. Congress is involved in World

Bank programs, presenting an opportunity for a cooperative government/industry front from the U.S. The bank will issue a 1992 World Development Report outlining major guidelines and projects. New facilities are constantly being developed within the bank presenting new opportunities, such as a new environmental facility developed in 1990 and capitalized with $1.3 billion over the next three years. A strategic approach and implementation need to be developed, representation and lobbying efforts increased, and a long term plan put in place for achieving some of these projects.

Major corporations should review their own ranks and their peers to examine the opportunities for teaming, for joint ventures to capitalize on very large projects, and the drawing together of leading edge technologies for mutual advantage.

Such entities as the Asian Development Bank, the International Business Opportunities Services of the World Bank (monthly operational summary) covering opportunities in Africa, Asia, Europe, the Middle East, North Africa, Latin America, and the Caribbean provide ongoing timely summaries of projects for bid and award. Projects contain a description of the scope of work, names and addresses of executing agencies, loan amounts, industry sector and subsector, the project officer and telephone number.

CONCLUSIONS

There is an enormous amount of information and technical assistance available to support export activities. In fact, there is so much information that many companies are overwhelmed by the amount of data and the complexity of entering unfamiliar markets and are not taking advantage of these opportunities. Despite this hesitancy California had foreign exports worth $53.5 billion in 1989, the most of any state. Deployment of Japanese or German trading models which leverage inter-firms linkages as well as linkages between the financial, manufacturing and governmental sectors could lead to significant growth in exports.

Total commitment to exporting is the reason for Germany and Japan's success in international trade. This commitment includes government, banks, trade associations, chambers of commerce, universities, and off-shore corporations which serve as their trade networks and conduits. The Japanese have a vast communications network and extensive presence in world markets. The Germans and British have a financial presence in the remotest regions, yet American presence, except in large markets, is minimal. The bottom line is that "you can't do the deals unless you're there!"

Americans need to use the German and Japanese models to learn how to coordinate, facilitate, share information and resources overseas, establish a presence in areas where there is market potential and develop relationships necessary to succeed. By using elements of the German model Los Angeles County could provided the leadership and facilitation needed to implement an "Industrial Export Policy."

IMPLEMENTATION STRATEGY

Existing export capabilities of large aerospace firms should be used as the springboard for an industrial export program similar to the German model. This could be done by expanding the offshore marketing programs of these large firms to include their suppliers and customers. This would build on existing working relationships where there is trust, knowledge of products, and complimentary relationships among products. The large aerospace firms that become the hubs for these industry network marketing programs could benefit by having some of their costs offset as well as by their enlarged market presence. Their suppliers and customers would benefit by cost sharing arrangements and by having access to their expertise and market relationships. The steps to implement this strategy would be

1. Identify Los Angeles County's existing export network by compiling an inventory of companies, banks, associations, trading companies, and export programs with an international marketing presence. This inventory should be organized by region, country and product. It should include programs of the Greater Los Angeles World Trade Center Association and the California Department of Commerce.

2. Offer financial incentives to companies and organizations with an international marketing presence to encourage them to:

   - Identify and share trade opportunities with other Los Angeles area businesses.

   - Provide office, telephone, fax, technical, secretarial and other in-country support to their own suppliers, customers, clients or members.

   - Provide in-country leadership in supporting establishment of a permanent Los Angeles County trade presence. A permanent presence would be desirable in major markets and could be in the form of a Los Angeles Area Chamber of Commerce, an industry-specific trade association, or an export trading company that could provide the office, fax, telephone, technical and other assistance to support continued in-country export promotion.

3. Flesh-out the information about national and international export related support contained in this chapter and combine it with the inventory of existing in-country activities supported by Los Angeles County firms and organizations to create a complete matrix of the types of support, staff, programs, and opportunities the exist by country and organization, to enable targeting of resources.

4. Establish a Los Angeles Area Trade Office in countries where these are high volume trade opportunities and establish an identity as a "player" in those marketplaces.

5. Establish a payback policy for firms using the new in-country trade facilities who are successful bidders. The payback policy should enable the offshore operation to become self-sustaining through successful trade efforts after a subsidized start-up period.

6. Enlist Los Angeles area business leaders, bankers and community leaders to provide visibility and support for the "Industrial Export Policy" by

   - leading trade missions;
   - hosting visiting company or country officials;
   - visiting Los Angeles trade offices in other countries; and
   - publicizing these and other efforts to deep the export initiative in the forefront.

7. Leverage assistance from the U.S. government by supporting and promoting Los Angeles area business participation in trade missions and feasibility studies. Federal agencies will be responsive to proposals for involvement from the County and its high tech industries.

RECOMMENDATIONS

It is recommended that the Los Angeles County Board of Supervisors:

1. Select an organization to develop, operate and raise matching funds for a business information clearinghouse and an industrial export program for Los Angeles County. The goals of these efforts should be to

   - Strengthen collaborative efforts within Los Angeles County's high technology industrial complex to successfully develop, commercialize and export technological innovations.
   - Establish a long term presence in foreign markets.
   - Foster the building of in-country relationships.
   - Maintain a self-sufficient presence for Los Angeles area firms in major foreign markets.

2. Allocate prospective Economic Development Administration funds to the program to support start-up and initial operating costs.

3. Conduct annual reviews of program accomplishments, strengths and weaknesses, and make any changes necessary to ensure that the program is effective.

APPENDIX A

U.S. Financial Assistance Programs

Export-Import Bank (EXIM)

- Working Capital Guarantee Program - helps small businesses obtain pre-export financing from commercial lenders. EXIM will guarantee 90% of principal.

- Export Credit Insurance - through its agent, the Foreign Credit Insurance Association, EXIM offers insurance which covers political and commercial risks on export receivables.

- Guarantee Program - provides repayment protection for private sector loans to credit worthy buyers of U.S. capital equipment and services exports. Coverage is available for loans of up to 85% of the U.S. export value.

- Loan Program - provides competitive, fixed interest rate financing for U.S. export sales facing foreign competition backed by subsidized financing. EXIM extends direct loans to foreign buyers of U.S. exports and intermediary loans to responsible parties that make loans to foreign buyers. Covers is up to 85% of the U.S. export value.

- Lease Guarantees - offers lease guarantees for finance and operating leases to foreign entities covering U.S. manufactured goods. Covers large transactions only.

- Engineering Multiplier Program - stimulates exports of U.S. architectural, industrial design and engineering services. EXIM will extend loans or guarantees up to 85% of the U.S. export value of services involving projects with the potential of generating U.S. export orders of $10 million or double the contract, whichever is greater.

- Operations and Maintenance Contracts Program - helps U.S. firms compete with overseas contracts to operate and maintain new or established projects.

Export-Import Bank and Agency for International Development/Financing Facility for Capital Projects - provides $500 million of "mixed credit" finance for capital infrastructure project development for Indonesia, Pakistan, Philippines, and Thailand in construction, energy, telecommunications, and transport sectors.

U.S. Department of Energy - AID - TDP/Federal International Energy and Trade Development Opportunities Program - offers financial support to U.S. firms for pre-feasibility studies leading to potential energy trade and development opportunities.

Small Business Administration (SBA)

- Revolving Line of Credit Program - guarantees loans up to $750,000 the proceeds of which can be used to finance foreign market development or labor and materials needed to manufacture or wholesale for export. Maximum maturity is 18 months.

- International Trade Loan Program - offers small businesses that can significantly expand existing export markets or develop new export markets loan guarantees up to $1 million for facilities and equipment and up to $250,000 for working capital.

Agency for International Development (AID)

- Private-Sector Revolving Fund - The Bureau for Private Enterprise will consider loans or guarantees for projects in developing countries that have a substantial developmental impact through creating jobs, developing managerial skills, transferring technologies or sustaining a sound environment. Loans range from $250,000 to $1 million.

- Forfeit Guarantee Programs - This non-recourse financing guarantee program assists U.S. firms in obtaining financing for the export of manufactured goods, such as machinery, spare parts, automotive equipment, tools, and durable goods to AID-assisted developing countries. Terms up to 5 years and maximum of $1 million.

- Philippine Assistance Program - provides $25 million for feasibility studies to promote U.S. trade and investment. PAP seeks to identify major projects for U.S. exporters.

- The African Growth Fund - a joint AID-OPIC operation that makes available equity and loan capital for investment in Africa.

Overseas Private Investment Corporation (OPIC)

- Development Funds - three investment funds have been established to promote development in various regions and business sectors; these growth funds cover Africa, Eastern Europe and Environmental Investment.

- Investment Insurance - offers a number of programs to insure U.S. investments in friendly, less developed countries against risks of political violence, expropriation and inconvertibility of local currency. Will insure 90% of the investment and other programs available for contractors, exporters, and lessors.

- Finance Programs - medium- to long-term financing for overseas investment projects is made available through direct and guaranteed loans. Loans generally range up to $6 million and are reserved for projects significantly involving "small businesses" and guarantees as large as $50 million for projects sponsored by any U.S. company.

- Lease Financing Program - offers loans and guarantees to foreign leasing companies in which there is a significant U.S. private business interest.

- Small Contractor's Guarantee Program - will guarantee an eligible financial institution up to 75% of an on-demand standby letter of credit or other form of payment guarantee issued on behalf of a small business construction or service contractor.

Trade and Development Program (TDP)/Feasibility Studies - A primary activity of TDP is to grant funding of feasibility studies, consultancies, and other project planning services for major projects in developing countries. The studies are done by U.S. firms and include agri-business, educational technology, electronics, energy, minerals development, telecommunications, transportation and waste management. Grants range from $150,000 to $750,000.

Access to the Exim and SBA programs is provided by local banks and/or offices in Southern California. California's Export Finance Office, 107 S. Broadway, Los Angeles, CA is participating in Exim's new City/State Program. The director is Irene Fisher at (213) 620-2433 and provides financial advice, FCIA umbrella policy and pre/post shipment loan guarantee packaging. The Small Business Administration's District Office Director is Hawley Smith, 330 N. Brand Blvd., Glendale, CA (213) 894-2956.

International Financial Assistance

International Financial Corporation
The International Finance Corporation (IFC) is the world's largest multilateral organization that provides financial assistance in the form of loan and equity to the private sector of developing countries. IFC's purpose is to provide economic development of its developing member countries through the support of the private sector. IFC can help prospective foreign investors find local partners and negotiation with the host government. IFC is affiliated with the World Bank, but operates as a separate organization. It utilizes the Bank's public sector infrastructure development programs to support investments in private sector projects. The IFC in 1990 approved $1.5 billion in new investments in 122 projects in 38 countries.

The World Bank
The World Bank grants loans to developing countries which evolve into specific projects which are competed worldwide. Depending on the size of the project multiple financial sources exist such as the Asian Development Bank, the African Development Bank, the Inter-American Development Bank and the International Development Association to name a few. The criteria and funding levels are on a case-by-case basis which includes country, type of project, funding sources, but does provide additional sources of capital.

U.S. Technical Assistance Programs

The U.S. Department of Commerce (DOC) has 68 domestic offices--including Los Angeles--and staff in 67 countries. The domestic offices provide information on trade and investment opportunities; foreign markets for U.S. products; financing aid; trade exhibitions, export documentation requirements, export licensing and foreign import requirements and export seminars and conferences.

The overseas offices gather on-site leads, provide background information on foreign companies, market research, assistance in making appointments with buyers and government officials and so on.

DOC has country desk officers who provide up-to-date information on economic and commercial conditions in their specific countries. They have information on each country's regulations, tariffs, business practices, trade data and trends, market size and growth. There is a separate organization which promotes trade by industry sector. The seven units are Aerospace, Automotive Affairs and Consumer goods, Basic Industries, Capital Goods and International Construction, Science and Electronics, Services, and Textiles and Apparel. A cross-sectoral unit--Trade Information and Analysis--provides data and analyses useful in export promotion.

Their National Trade Data Bank (NTDB) and Economic Bulletin Board (EBB), which California's Automated Trade Library Service (ATLS) subscribes to, provides information on trade shows, trade missions, matchmaker events, and overseas fairs and events. In addition, DOC will assist the private sector in organizing their own trade missions. Commerce also provides information about foreign standards and certification systems.

The Small Business Administration provides export counseling and legal advice for small companies through an arrangement with the Federal Bar Association. The program is called Export Legal Assistance Network (Elan). One-on-one assistance by members of the Service Corps of Retired Executives (SCORE) and basic business counseling from the Small Business Development Centers (SBDCs) is also available.

A recent grant from SBA to the Export Managers Association of California permitted the establishment of a new Export Small Business Development Center of Southern California which opened in November 1991, and is providing free consulting services to small- and medium-sized businesses wishing to expand into exporting. Ed Garber Associates, the SBA, and General Bank Corporation have recently established an Exporters Letter of Credit Facilitation Service in Los Angeles geared to the small exporter.

The Trade and Development Program (TDP) has begun sponsoring "reverse trade missions" which bring into the U.S. potential buyers for U.S. products. The Latin American Environment and Hemispheric Technological Cooperation Conference was held in La Jolla, November 17-19 and included representatives from Venezuela, Mexico, Chile, and Brazil.

The State Department and foreign service professionals provide insights into programs of foreign marketing and doing business abroad.

The federal government established the Trade Promotion Coordinating Committee (TPCC) to implement the Commercial Opportunities Initiative. The TPCC is comprised of 16 agencies and is charged with coordinating federal programs to assist U.S. firms into international trade.

Chapter 15

AIR QUALITY COMPLIANCE

A BUSINESS RETENTION STRATEGY

by Daniel Flaming

INTRODUCTION

The challenge of achieving National Ambient Air Quality Standards has made air quality regulations one of the most powerful forces shaping the course of economic development in this region. Air quality regulations are making significant contributions to public health and a cleaner environment, as well as stimulating technological innovation and the growth of new industries related to controlling pollutants. The cost of this progress is that some businesses are faced with compliance expenses and operating restrictions that reduce their competitiveness and, in some instances, cause their decline. The issues of environmental health and economic well-being have become increasingly intertwined as this region responds to the challenge of creating a healthy environment and sustaining a healthy economy.

At a time of national economic downturn and severe downsizing of the State's single most important industry, defense, it is fundamentally important that attainment of clean air in the South Coast Air Basin contribute to, rather than detract from, the long term health of the regional economy. Achieving the best possible fit between air quality regulations and the structural characteristics and dynamics of change in the aerospace industry is important because emission control standards are becoming increasingly stringent while survey responses indicate that aerospace firms already find current air quality regulations one of the most adverse aspects of the County's business environment.[1]

The South Coast Air Quality Management District (AQMD) has been a path-breaking agency in developing rules clearly based on benefit to the environment, technical feasibility and cost effectiveness. Because of very stringent Environmental Protection Agency air quality attainment requirements the AQMD has had to increase the scope and depth of its rule making. As air quality regulations have an increasing impact on vulnerable sectors of the business community and the work force it is very important that the District's regulatory process balance its commitment to the environment with comparable sensitivity and commitment to:

- Development of a robust economy.
- The need for gainful employment that supports quality of life for all segments of the work force.

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[1]See Chapter 1, pages 13 to 15 and Table 6, page 29, for information on survey findings about business environment factors.

AEROSPACE INDUSTRY PERCEPTIONS OF AIR QUALITY REGULATIONS

A primary complaint of aerospace firms is the regulatory environment in Los Angeles County, and requirements for air quality compliance are viewed as the most problematic regulatory area covered by the survey. At the same time, aerospace firms rate the weather and natural resources, which are safeguarded through environmental regulations, as assets of the region.

When asked to rate different aspects of the Los Angeles business environment, aerospace firms gave the following responses:

Ratings of Business Environment Factors

Business Environment Factors	Major Strength Of Los Angeles	Competitive With Other Regions	Neutral	Disadvantage To Doing Business In Los Angeles	Deterrent To Doing Business In Los Angeles
Cost of Air Quality Compliance	2%	2%	11%	31%	54%
Technical Difficulty of Air Quality Compliance	2%	2%	23%	35%	38%
Bureaucratic Difficulty of Air Quality Compliance	0%	1%	14%	31%	54%
Anticipated Environ-mental Regulations	1%	0%	17%	30%	52%
Natural Resources	22%	29%	39%	9%	1%
Weather	64%	24%	11%	2%	0%

The responses shown above indicate an appreciation for the end result of air quality regulations, desirable weather and natural resources, but serious concern about the regulatory process for achieving clean air. These ratings of air quality regulations are among the most negative for any factor in the Los Angeles business environment covered by the survey. In view of the importance of aerospace for Los Angeles County and the apparent link between negative perceptions of the business environment and plans of a number of aerospace firms to move jobs out of this region, it is important that changes be made which will improve these adverse industry views of air quality regulations.

CHANGES IN AIR QUALITY MANAGEMENT PROCEDURES

Hostile industry attitudes about air quality regulations identified in the aerospace survey are a legacy of the South Coast Air Quality Management District's past regulatory strategy of increasingly demanding command-and-control procedures. As a result of a self assessment process that led to its recently launched "New Directions" program, the District concluded:

> The AQMD permit process was not designed to deal with today's regulatory program. Our system was designed to carefully evaluate and regulate major industrial polluters, like electrical utilities, refineries, chemical plants, and hazardous waste incinerators. However, this isn't the best way to regulate the larger number of small businesses. The process was not designed to provide step-by-step assistance to overburdened and bewildered small business owners who needed to know not only how to comply, but why. Further, the existing regulatory framework did not allow for the flexibility and sensitivity needed to address many of the broader social and economic issues surrounding needed clean air rules.
>
> In sum, AQMD recognizes that the short- and long-term success of its clean air plan requires new approaches.[2]

The AQMD is adopting a "customer service" approach intended to correct many of the concerns identified by aerospace firms. Aerospace firms will experience a distinct improvement in the air quality regulatory environment if they are effectively linked with these recent changes in AQMD practices. Some elements of the New Directions program that will make air quality regulations more streamlined and flexible are:

1. **Quicker Review of Permits** - Minor sources of emissions will be able to obtain permits within a week and moderate sources within thirty days. These two categories account for more than two-thirds of AQMD's permits.

2. **Consolidated Permits** - Permits will be handled on a facility or project basis rather than issued separately for each item of equipment. This will allow entire projects to be reviewed and evaluated on a single, consolidated schedule.

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[2]South Coast Air Quality Management District, "Keeping the Clean Air Promise: New Directions in Air Quality Management," p. 4.

3. **Single Point of Contact** - There will be a single point of contact within the Engineering Department for each firm. This will enable each firm to deal with a single functional unit in the AQMD to coordinate all of its permits and approvals.

4. **Pre-Certification of Equipment and Materials** - Equipment and industrial materials that are mass produced and used under similar conditions are being certified as meeting AQMD's requirements when they roll off the assembly line. Businesses that purchase certified equipment or materials can be assured that they will get their permits quickly, either by mail or over the counter. The regulatory burden is being shifted from users to manufacturers of industrial equipment and materials.

5. **Privatization** - A pool of independent engineers is being trained and certified to provide verification that facility construction is done in compliance with permits. This will speed up the issuance of operating permits.

6. **Source Education** - Permit holders are able to receive free training about rules, compliance procedures, and equipment inspection.

7. **Technical Assistance** - Engineers have been assigned to the Small Business Assistance Office to conduct informal inspections of firms and informally advise them about compliance problems.

8. **Financial Assistance** - The AQMD has allocated $3 million, which will leverage another $10 million in State funds, to create a loan guarantee fund to help small businesses obtain financing for purchasing emission control equipment.

9. **Market Incentives** - This program will allow firms to shift part of the allowable emissions envelope from one establishment to another, and it will also give firms flexibility in deciding where within their operations they will achieve necessary reductions in emissions. This will give firms the flexibility, for example, to use high emissions coatings required by military specifications if they make offsetting emissions reductions in other parts of their operations.

10. **Technology Advancement Office** - The AQMD has established a Technology Advancement Office which is the largest program of its kind in the nation for researching and developing innovative air pollution control technologies. The aggregate value of this program totals more than $40 million, making it a potentially important source of research and development seed funding for the region's high technology industrial complex.

The ten changes listed above are supported by a training program to instill a sense of "customer service" in AQMD staff. Inspectors and engineers from the AQMD are now required to provide their business contacts with "customer satisfaction" postcards to tell the

District how well they were treated. Information from these evaluation forms goes directly to the AQMD Executive Officer.

These initiatives reflect an effort by the AQMD to solve air quality problems in collaboration with industry. The recently implemented changes outlined above are directly responsive to many of the complaints about the AQMD most often cited by the firms surveyed.[3] In the survey, 82% of the firms indicated that future environmental regulations will be a disadvantage or deterrent to doing business in Los Angeles, and 85% give a similarly negative rating to the AQMD bureaucracy. There is a need to link aerospace firms with these recent changes in AQMD practices, and to make firms aware that the public sector is making concerted and effective efforts to respond to industry needs. The implementation recommendations below set-out steps for making this linkage.

RECOMMENDED IMPLEMENTATION STEPS

1. All firms that responded to the Economic Roundtable survey should receive letters that address the following issues:

   - Inform firms about the AQMD's New Directions program and provide the name and telephone number of a contact person in the AQMD who will be their point of contact with the District.

   - Invite firms to waive the confidentiality of their survey responses so that copies may be given to the AQMD, which should designate its Public Advisors Office to work directly with those firms that have indicated a high level of frustration with AQMD regulations.

2. Identify the AQMD as an ally of high technology industrial development in the region through the following steps:

   - Establish an advanced technology industry forum under the auspices of the AQMD for sharing information and exploring possibilities for cooperation between the AQMD and high technology industries in the region. This forum should be convened on a regular basis to discuss regulatory issues affecting the high technology industrial complex and also the technologies needed by the AQMD to reduce emissions. Firms which responded to the aerospace survey should be invited to participate in this forum.

   - Adopt a policy objective of linking Technology Advancement Office research grants with high technology industrial development goals for the region. The intent of this policy objective should be that when it can be justified on the

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[3]The survey was concluded in November 1991, prior to the initiation of the New Directions program.

basis of merit and cost effectiveness, the high technology research and manufacturing resources of this region should be used to provide the technologies needed by the AQMD. This could be important for industrial development in the region. AQMD regulations are creating many new markets for emission control equipment, requiring significant levels of industry investment, but these investments could provide local industries with a first mover advantage in supplying emission control equipment for a global market that will follow precedents being set by the AQMD.

3. Earmark a portion of AQMD loan funds for small business assistance to help high technology firms reduce emissions and also become more competitive. Compliance with environmental regulations can take a firm down either of two paths. The desirable path is for firms to adopt clean production technologies that reduce emissions through retooling and modernization which makes them more competitive in the world market. The undesirable path is for firms to simply add emission control devices that add to compliance costs and reduce efficiency. By targeting a portion of its small business assistance resources on high technology firms the AQMD could be a catalyst for stimulating retooling and technology advancement in the region.

Chapter 16

REDUCING THE BURDEN OF WORKERS' COMPENSATION: A BUSINESS RETENTION STRATEGY

by Michael N. Beltramo

INTRODUCTION

Workers' Compensation has been widely identified as a major disincentive for doing business in Los Angeles County. For example, 86 percent of California companies queried for a 1991 California Business Roundtable study identified Workers' Compensation as a major factor in determining whether to expand within California or relocate operations out of state.

The Economic Roundtable conducted a survey as part of this study. Firms of all sizes responded to the survey by consistently rating California's Workers' Compensation system as a disadvantage or deterrent to doing business in Los Angeles County.[1] A breakdown of the ratings by firm size is shown on the following table.

Workers' Compensation Responses by Firm Size

FIRM SIZE (Employees)	RATING
Average	4.33
<= 100	4.17
101-500	4.12
501-1000	4.82
>1000	4.21

Since larger firms dominate the defense market in Los Angeles County, special attention was paid to their responses. The breakdown of responses by firms with more than one thousand employees is shown in Figure 1. Respondents from the two firms that rated Workers' Compensation in Los Angeles County as "Competitive" were contacted to gain

[1]Their average rating of Compensation was 4.33 on a scale of 1 to 5 with 5 being the worst.

thousand employees is shown in Figure 1. Respondents from the two firms that rated Workers' Compensation in Los Angeles County as "Competitive" were contacted to gain insight into why they differed from their counterparts and how they managed their programs. One of the respondents was not involved with the human resources side of the business and had little knowledge of his firm's experience in that area. But the other's comments were telling. He made two important comments about why Workers' Compensation did not pose a problem to his firm:

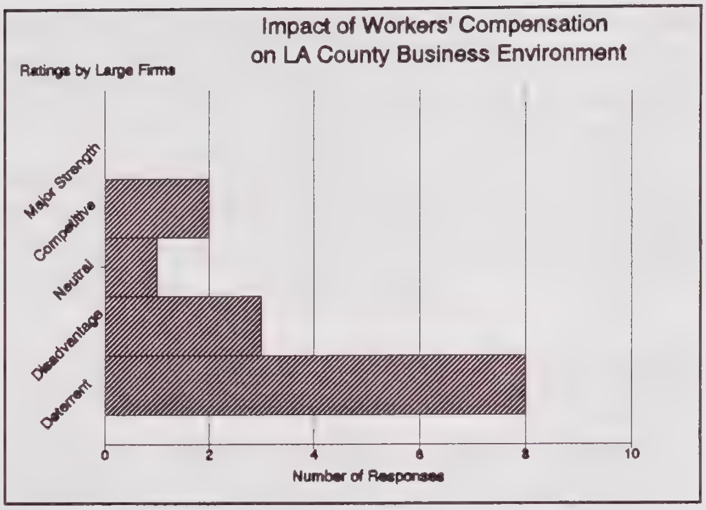

Figure 1

• They had already moved virtually all manufacturing operations out of California to avoid unfriendly environment of Los Angeles County.

• They adopted an aggressive/hands-on approach for dealing with Workers' Compensation claims and health and safety concerns in the work place.[2]

Therefore, it is fair to say that the California Workers' Compensation system is seen by defense firms as a major disadvantage to doing business in Los Angeles County. The evolution of Workers' Compensation, its associated costs, and some alternatives (both internal and external) for coping with the problem are discussed below.

BACKGROUND

Workers' Compensation originated in Europe during industrial revolution in the late 19th century to cover physical injury on the job. In 1911 Workers' Compensation was adopted by ten states to protect the income of victims of work related accidents. It was established as a no fault program. Before Workers' Compensation, employers had been responsible for work related injury or death related to their negligence. This proved to be slow, costly, and uncertain. All states eventually adopted Workers' Compensation laws which have six common objectives. They are:

• Prompt, reasonable income and medical benefits to victims regardless of fault.

• Single remedy that reduces court delays, costs, and workloads of personal injury litigation.

[2] This issue is discussed below in greater detail.

- Relieve public and private charities of financial drain.

- Eliminate payment of fees to lawyers.

- Maximize employer interest via experience rating whereby employers with poor safety records pay more.

- Promote frank study of causes of accidents rather than concealment of fault.

These are important public objectives and should be closely protected. Unfortunately, the California system has long tempted less scrupulous members of the work force and their agents to file false claims. This temptation has often been manifest in injuries such as back pain that have been difficult to detect with precision.

This temptation has become more pronounced with the shift of the economy from goods producing to information and service industries. The shift from a physical load to a mental load has added a major burden to the system in the form of stress claims. States differ widely in their treatment of such claims. The following provides a hierarchy of stress as a compensable work place injury:

- Stress is not compensable
- A sudden or shocking incident caused stress
- Unusual occurrences caused stress
- Not unusual, but normal events caused stress

Only the liberal California and Oregon systems provide compensation for the final category of stress. Examples of awards for such claims would be unbelievable except for their frequency and consistency. One large firm contacted as part of this study told of an employee who received an award because he found the requirement for arriving at work on time too stressful. A recent *Los Angeles Times* article reported about a physician who received an award because he was upset by actions related to his prosecution for fraud (of which he was convicted).

California Workers' Compensation has contributed to the state's anti-business image and has served as a reason for businesses to locate or relocate elsewhere. The costs of the system are discussed below.

WORKERS' COMPENSATION COSTS

The enormity of California's Workers' Compensation system is underscored by its $11 billion budget in 1991. That was more than $2 billion larger than Los Angeles County's defense industry. Mory Framer of Barrington Center noted that firms spend ten percent of earnings defending stress, during the 1980's and that Workers' Compensation claims

increased by over 700% in Southern California during that period. Furthermore, stress has become the leading occupational disease in Los Angeles County today.

Unfortunately, inadequate study has been done regarding the true economic cost of the California Workers' Compensation system. It begins with the direct cost of the insurance payment. But it does not end there. Many other factors, monetary and nonmonetary, must also be considered. The monetary factors include, among others:

- Additional insurance premiums based upon employer safety history,
- Legal defense against unwarranted claims,
- The cost of settlement for cases the employer is unwilling to litigate.

Costs associated with these factors have two characteristics that businesses try to avoid: they are high, and, more important, they are very uncertain. Nevertheless, the monetary costs may be much less significant than the factors which indirectly impact productivity and competitiveness.

The inclusion of stress that is not unusual provides indolent workers with a legal form of extortion: "If you...or if you don't..., then I'll file a claim." For example, they may threaten to bring action against a firm because of normal disciplinary actions. This has a chilling effect in the work place by creating morale problems between two classes of employees: those who are willing to use the Workers' Compensation club and those who are not. Furthermore, it can severely limit the authority of supervisors who may be reluctant to pursue normal means of providing reprimands.

Workers' Compensation for stress is easy to claim and hard to disprove. Therefore, it has been shown to provide a tempting, ready source of needed funds for employees who find themselves in a financial bind. In fact, human resources professionals counsel that a sound means of managing a firm's Workers' Compensation program is to screen out prospective employees with poor credit histories.

There are two issues that stand out regarding Workers' Compensation:

- The job losses associated with the misguided Workers' Compensation system represent a real toll on our society. The burden is felt directly by responsible employees and those who tolerated malingering coworkers being laid off as their plants relocate. It is felt by us all indirectly in terms of a lower tax base as a result of firms leaving the area.

- The system does not provide well for those for whom it was designed: honest employees who are injured on the job. The California Workers' Compensation Program has the *highest per capita cost* in the nation yet injured workers here receive the *lowest benefits*.

Thus, fraud, abuse by providers, and litigation costs are channeling resources away from the injured worker, wages, and jobs. Reform is clearly required. To achieve maximum effectiveness of the system changes must occur at both the state legislative and firm management levels.

LEGISLATIVE REFORMS

Recently, the state legislature has reacted to the Workers' Compensation problem by acting to correct some of the more flagrant abuses of the system. That is the good news. The bad news is that these actions do not go nearly far enough. The legislation is described below.

Assembly Bill (AB) 971 (Peace) became effective on September 17, 1991. It limits stress claims related to usual circumstances to employees who have been employed for at least six months. However, they may receive benefits for mental stress related to "sudden and extraordinary" actions. Also, they could apparently file claims for stress related to "regular and routine" occurrences during the first six months of employment after their employment had exceeded that duration.[3]

Senate Bill (SB) 1218 (Presley) which became effective on January 1, 1992 was designed to curb fraudulent claims. It designates that criminal fraud is committed by anyone knowingly making a false statement and provides punishment for up to five years in prison and/or $50,000 fine (or double amount of fraud-whichever is greater) for frauds related to Workers' Compensation. Additionally, it also:

- Provides for loss of license for fraud committed by health care professionals.

- Subjects procurers of patients and qualified medical evaluators who make false statements to misdemeanors.

- Makes false advertising regarding services or benefits punishable as misdemeanor after Department of Consumer adopts regulations by 1993.

Thus, the Presley Bill helps by defining criminal actions related to the Workers' Compensation system. But it may not have sufficient funding to make it fully effective. AB 1673 (Margolin) funds prosecution of fraudulent Workers' Compensation cases at somewhat more than $3 million per year. This will enable only the largest systematic abusers of the system to be prosecuted.

In summary, the state legislature recognizes that a problem exists but apparently does not comprehend its severity. Therefore, businesses must take a hard look within their own

[3]"Regular and routine" employment stress may be caused by: discipline, work evaluation, transfer, demotion, layoff, or termination.

operations to decrease their liability. Some practices of firms that have achieved success in this area are summarized below.

INTERNAL WORKERS' COMPENSATION REFORMS THAT HAVE WORKED

Many firms have recognized a poor history with Workers' Compensation as a symbol of underlying morale problems that must be corrected. They acted on two fronts. The first is to identify and eliminate unsafe practices in the work place. Next, management must deal with legitimate Workers' Compensation claims in a caring and sensitive manner.

A successful approach to dealing with these matters has been to fund health and safety activities and to administer claims in a manner that assures that injured employees will receive their benefits expeditiously. One firm decentralized the management of Workers' Compensation at the unit level. This made it a bottom line item rather than an unmanaged component of overhead. These actions involve a greater expenditure of resources initially but pay significant benefits.

The other significant action taken together with those noted above has been an aggressive handling of questionable claims. Two "rules" have proven particularly effective in scaling back Workers' Compensation costs:

- Investigate all stress claims
- Never agree to nuisance settlements as they encourage blackmail.

Thus, firms must bear part of the responsibility for keeping a lid on Workers' Compensation claims. They can best achieve this by treating employees with fairness and compassion until there is reason to suspect abuse of the system. Then they should use legal remedies to deter dishonesty.

RECOMMENDATION

The California Workers' Compensation system has been cited by Los Angeles County defense firms as an important deterrent to doing business here. Their objections are reasonable and accurate. The system has many serious faults. The more important ones include:

- High and uncertain direct costs.
- An impact on productivity that severely hurts competitiveness.
- Low benefits to legitimate claimants.

Legislative remedies are required to return the system to its original intent, i.e., providing prompt, reasonable income and medical benefits to victims regardless of fault. This implies that unproductive expenditures for medical/legal claims mills be curbed. Claims for stress caused by factors normal to the employment environment should, not be allowable.

It is recommended that the Los Angeles County Board of Supervisors instruct the County's legislative representative in Sacramento to work on behalf of legislative approval of Workers' Compensation reform measures to correct the abuses identified in this report.

RECOMMENDED PRIORITIES

Based on the findings of this study, the Economic Roundtable recommends the following major actions to initiate an Economic Adjustment Strategy. Recommended actions are listed by order of their priority, beginning with the highest priority.

ACTION	BENEFIT
1. Establish an industry-government-university council to oversee development and utilization of strategic data, integrate public sector policy objectives, and implement an industrial development strategy.	*Creating an informed regional consensus around industrial development is a make-or-break task for preserving the competitiveness of Los Angeles' high technology complex. This is a prerequisite for establishing long-range goals that provide a stable frame of reference for public sector coordinating activities.*
2. Initiate and support business retention efforts such as AQMD's New Directions program, reform measures to correct Workers' Compensation abuses, and housing assistance for USAF Space Systems division.	*Removing business disincentives and retaining Los Angeles County's existing high technology industrial base with its skilled employment opportunities is important for sustaining a dynamic regional economy because there are no large scale, near term prospects for replacing these jobs.*
3. Establish a university-industry consortium to build on regional technology strengths by developing and commercializing clean energy and power sources.	*This consortium will accelerate development of non-defense dependent technologies, boost development of a clean transit industry, and assist the public sector in formulating policies related to technological development.*
4. Reform the job training system to have greater flexibility and make available long-term retraining and supportive services.	*One of Los Angeles County's strongest competitive advantages is its skilled labor force. It is in the public interest to maintain this highly skilled and productive advanced technology workforce through retraining and optimal job matches.*
5. Provide seed capital and extensive technical assistance for high technology start-up businesses.	*The greatest opportunities for job creation and industrial diversification are with the small and start-up companies. By making capital available for R&D and providing technical assistance, the County can capitalize on their growth potential.*
6. Provide an information and business opportunity clearinghouse to increase linkages among high technology firms.	*Identifying business opportunities and increasing the flow of information between firms will support and stimulate job growth in the small business sector.*
7. Support the development of an export strategy based on the German model, linking the export services of large firms with their networks of suppliers and customers.	*To offset shrinking domestic commercial and defense markets, it is necessary to assist small and medium size firms in understanding and gaining access to export markets and export financing assistance.*
8. Stimulate the development of advanced surface transportation industries by providing funds for renovating vacant defense manufacturing facilities for this use.	*Excess defense facilities offer a window of opportunity for matching physical infrastructure with emerging industries and stimulating the growth of new high technology manufacturing activity in Los Angeles County.*

PROJECT TEAM

Daniel J. Flaming, Ph.D. is President of the Economic Roundtable. He has over 20 years experience administering and conducting policy research for public sector programs in community development, job training, and industrial development. Dr. Flaming earned his Ph.D. from University of Southern California in Public Administration and his M.A. from University of California, Los Angeles in Urban Planning.

Elizabeth M. Reid is Vice-President of the Economic Roundtable. She is responsible for labor market and industry analysis for the Economic Roundtable and has developed and implemented a wide range of community-based economic development projects throughout the region. Ms. Reid earned her M.A. from University of California, Los Angeles in Urban Planning and her B.A. from Bucknell University in International Relations.

Allen J. Scott, Ph.D. is a Professor of Geography at University of California, Los Angeles and Director of the UCLA Lewis Center for Regional Policy Studies. He internationally respected as a leading expert on industrial location and industrial development issues. Dr. Scott earned his Ph.D. from Northwestern University in Geography, a M.A. from Oxford University and a M.A. from Northwestern University in Geography and African Studies.

Michael N. Beltramo, Ph.D. is President of Beltramo and Associates, a private consulting firm which specializes in developing competitive strategies for aerospace firms. For the past twenty years, Dr. Beltramo has advised U.S. and foreign decision makers from industry and government about economic policy issues within the unique marketplace for defense systems. He earned his Ph.D. from Rand Graduate School in Public Policy Analysis and his M.P.A. from University of Southern California in Public Administration.

Odessa Dubinsky is an independent labor market consultant. Ms. Dubinsky has served as a consultant to the U.S. Department of Labor, managed the Southern California Employment Data and Research Division of the Employment Development Department, and participated in many manpower program councils and education advisory groups. She earned her B.S. from Ohio State in Journalism.

David G. Hensley, Ph.D. is Director of the UCLA Business Forecasting Project. As Director he is responsible for the economic forecasts of the U.S. and California, and supervises the estimation and maintenance of the Business Forecasting Project's econometric and demographic models of California and Los Angeles. Dr. Hensley earned his Ph.D. from University of California, Los Angeles and his B.A. from University of Texas, Austin in Economics.

Katherine M. Bulow is President of The Bulow Group. She has served as Assistant Secretary to the U.S. Department of Commerce and Deputy Administrator for U.S. Small Business Administration. Ms. Bulow has special expertise in the areas of international trade markets, small business investment opportunities, and economic development programs.

Public Policy Analysis
by the

Economic Roundtable
315 W. 9th St. Suite 310
Los Angeles, CA 90015
213: 892-8104